



PDHonline Course C634 (8 PDH)

Grand Central: Grand by Design

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2020

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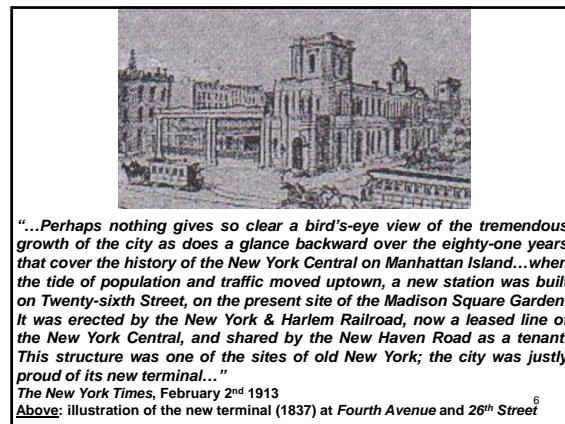
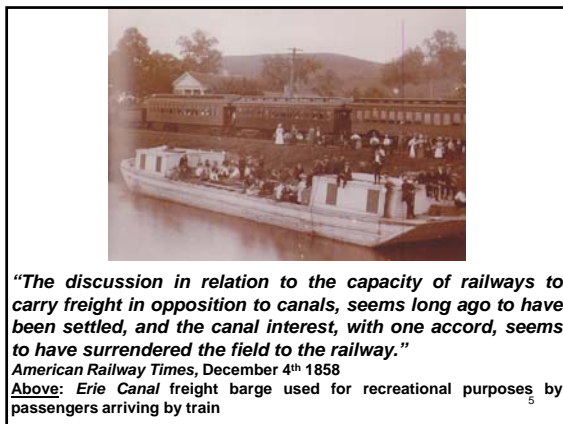


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Part 1

From Little Acorns

Surrendering the Field





Above: the first Madison Square Garden (opened in 1879). It occupied the NY&HRR depot at Madison Avenue and 26th Street (built in 1837). It became a successful 14K-seat venue that featured boxing, bike racing, circuses and ice hockey. The old station had been sold to P.T. Barnum (in 1871) who converted it into the Hippodrome. In 1879, it was renamed "Madison Square Garden." 7



"...The New York & Harlem Railroad was the earliest on Manhattan Island. It was built in 1832 and its terminal was on Centre Street, just back of the City Hall. At that time, however, the terminal was no more than the mere ending of the tracks, just as certain of the surface cars end their run there today...It was soon decided that a station was a proper part of a terminal's equipment, and so a little later we find the New York and Harlem Railroad building a station at White and Centre Streets, the present site of the Criminal Court Building..."

The New York Times, February 2nd 1913
 Above: illustration caption: "Pulling Cars from Twenty-sixth Street and Madison Avenue to Terminal near City Hall" 8

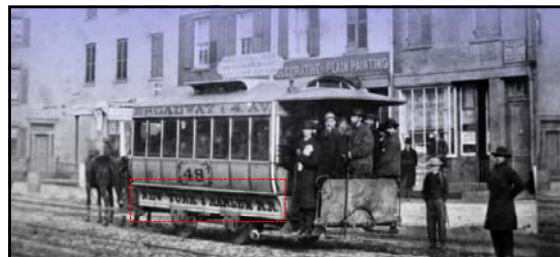


One of the NY&HRR's earliest stations in Manhattan was at Tryon Row (left). At the time, trains of two types were being pulled (a.k.a. "drawn") by horses;

- Short Cars – pulled by two horses (right);
- Long Cars – pulled by four or more horses

Downtown service used the shorter cars, and Tryon Row served as a switching point for people heading north (in the longer cars).

9



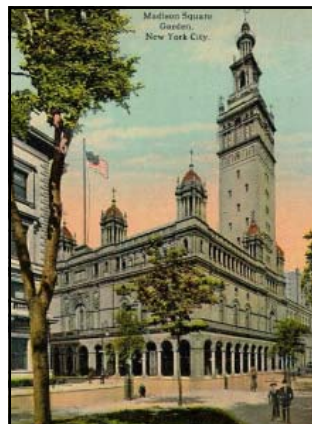
The NY&HRR was granted a charter authorizing a route from Fourth Avenue and the Bowery north to the Harlem River. It was incorporated on April 25th 1831 as the New York and Harlem Railroad, to link New York City with "suburban" Harlem. The first stretch was opened from Prince to 14th Street/s on November 26th 1832.
 Left: NY&HRR transfer token 10



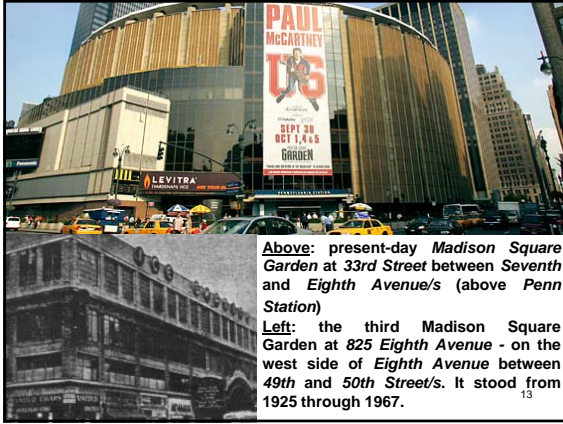
"...The city north of the new station soon began to solidify, the streets became filled with traffic, and the increasing number of passengers necessitated longer trains. When the trains grew to the unprecedented length of five cars, only the first three cars rounded the sharp curve at Broome Street and continued on to White Street. The other two were cut off where the rails left the Bowery. This expedient met conditions for a very short time. The city continued to grow, the Bowery began to be a real city street, and the people objected to locomotives running on it. To meet this difficulty the management planned New York's first 'uptown' railroad terminal. In 1837 the New York and Harlem Railroad station was completed at Fourth Avenue and Twenty-sixth Street, where the Madison Square Garden now stands, then the 'outskirts' of the Nation's metropolis..."

The New York Times, February 2nd 1913

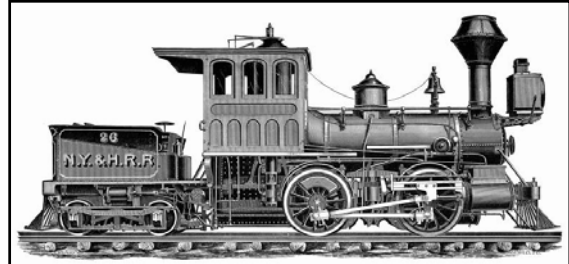
11



In 1889, the original NY&HRR depot (serving as the first MSG) was torn down. Architect Stanford White designed the second MSG in 1890. This beautiful, 8K-seat Moorish inspired structure (left) featured cupolas, arches and a 32-story tower that made it the second tallest building in the city. In 1925, it too met the fate of its predecessor and the third MSG was completed at 50th Street and Eighth Avenue. This arena was home to the Rangers, Knicks and famous boxing matches. By the late sixties, it was outdated and replaced (in 1968) by the fourth and current MSG, built on the site of the original Penn Station. 12



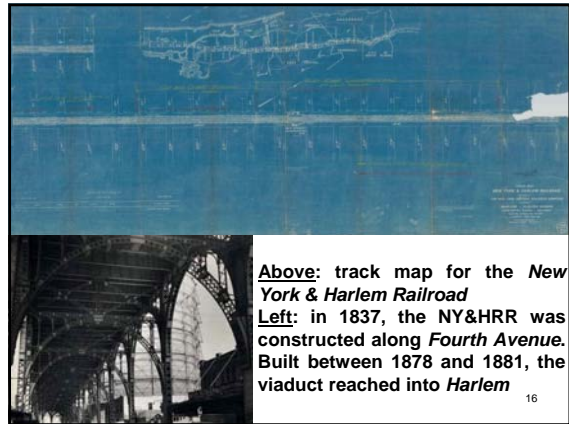
Above: present-day *Madison Square Garden* at 33rd Street between Seventh and Eighth Avenue/s (above Penn Station)
Left: the third *Madison Square Garden* at 825 Eighth Avenue - on the west side of Eighth Avenue between 49th and 50th Street/s. It stood from 1925 through 1967.



By 1837, the *New York and Harlem Railroad Depot* took root. It would eventually occupy the entire block bounded by *Fourth Avenue* and *Madison Avenue* (east-west) and *26th* and *27th Street/s* (north-south). In the latter part of the 1830s, the *New York and New Haven Railroad* and the *Hudson River Railroad/s* were built.



15



Above: track map for the *New York & Harlem Railroad*
Left: in 1837, the NY&HRR was constructed along *Fourth Avenue*. Built between 1878 and 1881, the viaduct reached into *Harlem*

16

The Future Growth of the City

17

“...Yes, New York was growing, and undoubtedly it would continue to grow. The new station at Twenty-sixth Street was constructed with an eye on the future growth of the city. It was used by the *New York & Harlem Railroad* and the newer railroad to *New Haven*, which used the former’s tracks south of *Woodlawn*. *Harlem* trains swung out from one side of the station, *New Haven* trains from the other. Its capacity caused *New Yorkers* to swell out with a vast amount of civic pride. They told out-of-town people, with much satisfaction, that 8,000 persons came in and went out by way of it every day. There were thirty trains each way a day...”
 The *New York Times*, February 2nd 1913
Top: the NY&HRR station at 23rd Street (ca. 1857)
Bottom: NY&HRR train schedule (ca. 1850s)

18

The Pleasant Suburban Streets

19

"...After the completion of this great terminal no locomotives were sent south of Twenty-sixth Street. Horses were used to draw the cars through the pleasant suburban streets to the heart of the city. A few stops were made at the busiest cross streets, such as Twenty-third Street, Fourteenth Street, and Canal Street. Soon there was more trouble for the railroad: people began to object to the locomotives running through Fourth Avenue to Twenty-sixth street, though the tracks lay through the Fourth Avenue tunnel from Forty-first Street to Thirty-fourth Street, now used by the trolley cars. The agitation became so strong that the railroad had to buy a big open lot at Forty-second street for its engine houses and send the cars south from that point drawn by horses..."
The New York Times, February 2nd 1913

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The Hudson River Railroad

21

"...The Hudson River Railroad was an independent line at that time that clung closely to the west side of the town. When it was first put in operation...the cars were sent out from a little covered shed at the southwest corner of Chambers Street and West Broadway. Then folks began to object to locomotives going through the streets, and cars were driven by horses to the yard at Thirtieth Street, where they were made into trains and the road engine attached. This was found to be unsatisfactory. Before the close of the civil war all passenger trains were being received and sent from Thirtieth Street. It is interesting to note here that it was at this station that Abraham Lincoln was received when passing through New York on his way to Washington for the inauguration of 1861..."
The New York Times, February 2nd 1913

22



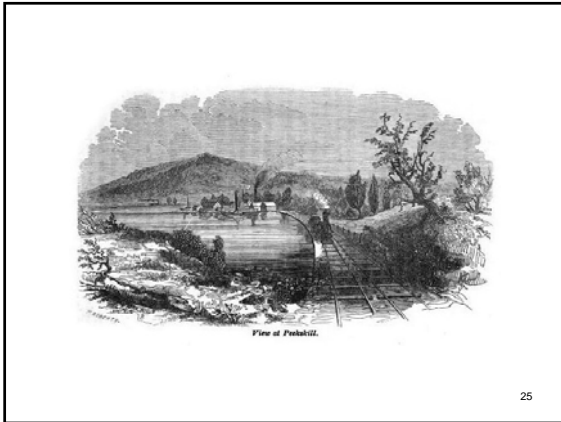
Above: a New York Central freight train on West Street (paralleling the Hudson River), looking north from 30th Street (ca. 1920). The tracks were part of the Hudson River Railroad's right-of-way.

23

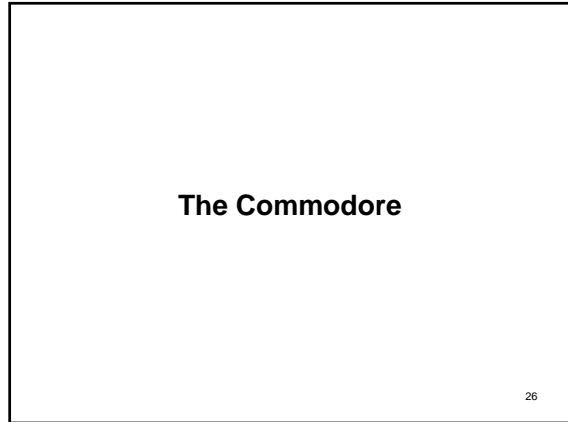


By 1841, the Erie Railroad connected Lake Erie and the Hudson River at Piermont. The railroads along the shores of the river followed. On the eastern shore, the Hudson River Railroad was finished in 1851, linking New York City and Greenbush, across the river from Albany. Once the Hudson River Railroad was built to Garrison (in 1848), it allowed the new prominent business class to have country estates within commuting distance of Manhattan. A Hudson Highlands "Millionaire's Row" evolved along the line on both the east and west side/s of the river, all the way up to Hyde Park where the Vanderbilt estate was located.

24



25

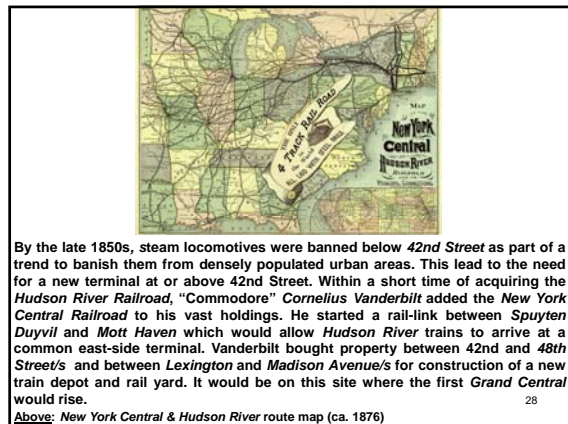


26

"...Commodore Vanderbilt began to play his part in the railroad affairs of the Nation...Late in the year 1862 this great railroad organizer set about buying the stock of the New York & Harlem Railroad. He is said to have bought much of it at \$9 a share. In less than a year the stock was being quoted at \$50 a share. What had caused this big jump? Rumors were in the air and in less than a twelvemonth they were justified. By 1864 Vanderbilt loomed up as the owner of a controlling amount of stock in the New York & Hudson River Railroad. With these two railroads in his control, Vanderbilt began the process of 'assimilating' a third – the New York Central. This was a union of ten little railroads, some running in the territory between Albany and Buffalo, others merely projected..."

The New York Times, February 2nd 1913

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By the late 1850s, steam locomotives were banned below 42nd Street as part of a trend to banish them from densely populated urban areas. This led to the need for a new terminal at or above 42nd Street. Within a short time of acquiring the Hudson River Railroad, "Commodore" Cornelius Vanderbilt added the New York Central Railroad to his vast holdings. He started a rail-link between Spuyten Duyvil and Mott Haven which would allow Hudson River trains to arrive at a common east-side terminal. Vanderbilt bought property between 42nd and 48th Street/s and between Lexington and Madison Avenue/s for construction of a new train depot and rail yard. It would be on this site where the first Grand Central would rise.

Above: New York Central & Hudson River route map (ca. 1876)

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29

"I never lease property – always buy"
Cornelius Vanderbilt
 RE: his response when offered to lease the block bounded by 46th/47th Street/s and Madison/Fourth Avenue/s. The Commodore negotiated with private landlords who owned the mostly vacant land, shanties or pastures that made up the parcel of land needed for the depot and train yard. The 1850 General Railroad Law of New York State gave the Commodore an unfair advantage since this law empowered railroads to acquire property while the state courts determined its value. Vanderbilt used his own considerable financial resources to purchase the land and "grease the wheels of progress" at Tammany Hall where nothing happened if William Marcy Tweed and his "magic ring" didn't get their cut. The Commodore was well versed in the ways and means of "Boss Tweed" and the endemically corrupt New York City government of the time. A fair market value for the Fourth Avenue block bounded by 42nd/43rd Street/s was \$350K – the Commodore paid \$25K, no doubt thanks to City Hall. The new depot and train shed/yard would begin construction in 1869 and opened for business on November 1st 1871.

30

"...Much of New York Central's terminal land at Forty-second street was acquired more than half a century ago when real estate prices were infinitesimal compared with quotations today. The company owns 47 acres which cost it, all told, \$22,000,000, or only \$10.75 per square foot. Per acre, the cost was \$468,085. Now if New York Central were to buy this same land today, it certainly could not get it for \$22,000,000, or \$100,000,000, and the doubt is well founded that \$122,000,000 would suffice. So the statement is likely to go unchallenged that New York Central had over \$100,000,000 worth of real estate which cost it \$22,000,000 when it launched its terminal-realty enterprise..."

The Wall Street Journal, December 1912

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"...Although the Central paid \$22,000,000 in all for the land, it is probably worth five times as much...It is unquestionably conservative to place the value today at \$100 per square foot. The corner of the property at Vanderbilt Avenue and Forty-eight Street, more than a block away from any part of the terminal and a much less desirable spot, a plot 27 by 100 feet was recently transferred at \$210,000 or \$77 per square foot; and another near it, 45 by 100, for \$300,000, almost \$70 per square foot..."

The Wall Street Journal, December 1912
 Left: view looking south down Vanderbilt Avenue (from E. 46th Street to E. 42nd Street (ca. 1935)

32

"...This reclamation work by the New York Central is reclamation work in one of the costliest stretches of ground on the continent. Its end is the recovery of city blocks where the very land of every block is worth between \$2,000,000 and \$3,000,000. It is restoration of land in a part of America where, according to estimates which experts have made, the very area taken up by one of the road's Pullman cars is worth \$30,000. It means the recovery and use of a great stretch of land that would cost an almost inconceivable fortune to buy..."

The New York Times, February 2nd 1913

33



"...The Manhattan Hotel site at Madison Avenue and Forty-second Street is estimated by real estate men to be worth more than \$200 per square foot. Around on the side streets leading away from the western side of the terminal, property brings at least \$50 per foot..."

The Wall Street Journal, December 1912

Left: Manhattan Hotel (left), Grand Central Station (right), ca. 1910

34

The Corsair Agreement

35



Left: "Commodore" Cornelius Vanderbilt, railroad baron and mastermind of the original Grand Central Depot. The Vanderbilt family motto was: *Great Oaks from Little Acorns Grow*, and the Commodore's heirs followed their patriarch's lead. *William H. Vanderbilt* inherited his father's acumen for business and began to acquire rail lines southwest of New York City, in *Pennsylvania Railroad* territory as far west as *St. Louis*. Not to be outdone, the *Pennsylvania RR* created a shore route paralleling the *Hudson River* with its terminus in *Jersey City, NJ*. This triggered a rivalry of monumental scale between the two great railroads. Financier *J.P. Morgan* recognized the threat posed to the U.S. economy by this rivalry thus he acted as intermediary between the two companies with himself emerging supreme. It came to be known as *The Corsair Agreement* since it was on his famous yacht *Corsair*, that the negotiations/agreement was finalized.

36

The Vanderbilt Look

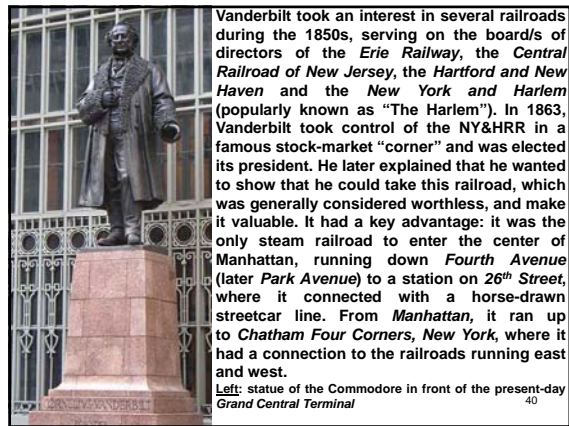
37



Above: sampling of the abundant acorn/oak leaf motif at *Grand Central Terminal* (GCT). The Commodore's grandson *William K. Vanderbilt*, played a significant role in the aesthetics of GCT. With the assistance of his architect cousin *Whitney Warren* (of *Warren & Wetmore*) he pushed for "The Vanderbilt Look" which always included a celebration of the acorn (potential) and oak leaf (realization) in honor of the family motto. ³⁸



Cornelius Vanderbilt II's mansion in *Newport, Rhode Island - Marble House* (above), shares much of the same Vanderbilt aesthetic as GCT, including a celebration of acorns and oak leaves. ³⁹



Vanderbilt took an interest in several railroads during the 1850s, serving on the board/s of directors of the *Erie Railway*, the *Central Railroad of New Jersey*, the *Hartford and New Haven* and the *New York and Harlem* (popularly known as "The Harlem"). In 1863, Vanderbilt took control of the NY&HRR in a famous stock-market "corner" and was elected its president. He later explained that he wanted to show that he could take this railroad, which was generally considered worthless, and make it valuable. It had a key advantage: it was the only steam railroad to enter the center of Manhattan, running down *Fourth Avenue* (later *Park Avenue*) to a station on *26th Street*, where it connected with a horse-drawn streetcar line. From *Manhattan*, it ran up to *Chatham Four Corners, New York*, where it had a connection to the railroads running east and west.

Left: statue of the Commodore in front of the present-day *Grand Central Terminal* ⁴⁰

The Great Operator

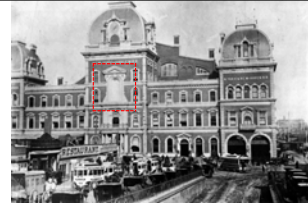
41

"The citizens of New York will be astonished in a few days, when they have an opportunity of beholding the colossal bronze statue, with allegorical accessories, erected in honor of Commodore Vanderbilt...whether we consider him as the great operator and financier or as the steamship Commodore and railway King, or as the man who gets married after the age appointed for men to die, or as the man who is the subject of a statue which, taken all in all, is without a parallel in this or any other country, we always find him the man of boldness, originality, and the most striking popular effects."
The New York Times, September 2nd 1869

42

The Virtues of Modesty

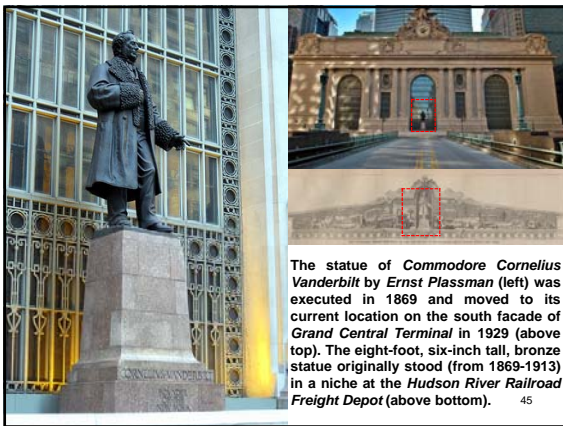
43



"...But the niche remained empty. Perhaps the earlier japes had convinced Vanderbilt of the virtues of modesty...For now, he stands a hostage, in a haze of exhaust produced by the railroad's most potent enemy, the automobile..."

Christopher Gray, Writer

RE: a large niche was left on the third floor of the new depot for a half-ton statue of the Commodore flanked by a sailor and an Indian. Perhaps it was due to attacks by the *New York Times* directed against Vanderbilt personally (suggesting the dismembered bodies of men, women and children killed crossing the tracks (north of *Grand Central Depot*) also be included as bronze figures on the facade) that discouraged the niche from ever being used for the purpose intended. ⁴⁴



The statue of *Commodore Cornelius Vanderbilt* by *Ernst Plassman* (left) was executed in 1869 and moved to its current location on the south facade of *Grand Central Terminal* in 1929 (above top). The eight-foot, six-inch tall, bronze statue originally stood (from 1869-1913) in a niche at the *Hudson River Railroad Freight Depot* (above bottom). ⁴⁵



Above: period cartoon depicting *Cornelius Vanderbilt* versus *Jim Fisk* in their famous rivalry for control of the *Erie Railroad*. In 1864, the Commodore sold the last of his fleet of ships in order to concentrate on railroads. Once in charge of *The Harlem*, Vanderbilt encountered conflicts with connecting lines. In each case, the strife ended in a battle that Vanderbilt won. He bought control of the *Hudson River Railroad* in 1864, the *New York Central Railroad* in 1867, and the *Lake Shore and Michigan Southern Railway* in 1869. He later bought the *Canada Southern* as well. In 1870, he consolidated two of his key lines into the *New York Central and Hudson River Railroad*. ⁴⁶



*"...With these three railroads under one control all that was needed was a short line from the Harlem tracks across to Spuyten Duyvil and a bridge across the Hudson at Albany, so that folks going west would no longer have to undergo the disagreeable ferry ride there: and the great through trunk line between New York and Buffalo was established, and took the name of the absorbed upstate road – the *New York Central*..."*

The New York Times, Feb. 2nd 1913 ⁴⁷

The Vanderbilt Era

48



"The creation of the New York Central & Hudson River stands as a historical landmark, showing us where the era of big business – the Vanderbilt era – well and truly began"

T.J. Stiles, Author

RE: the NYC&HR Railroad capitalized at a whopping \$90 million on January 27th 1870. In April 1870, the stock paid a \$3.6 million semi-annual dividend of 4% - the largest ever paid up to that time in the United States.



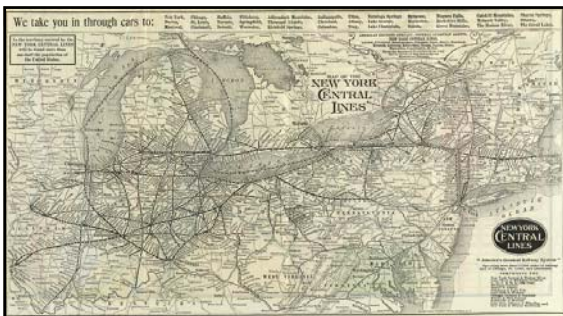
Before the Hudson Tubes, almost all railroads had their New York stations in New Jersey. The Pennsylvania Railroad's Jersey City terminal at Exchange Place was their main station for New York prior to the completion of Pennsylvania Station in 1910.



51



In 1883, William H. Vanderbilt (satirized in a period cartoon, at left) resigned his position/s as president and chairman of the New York Central RR, but remained on the board of directors overseeing operations. Born in 1821, he died in 1885 during a heated argument over business of an aneurysm. His two sons: Cornelius Vanderbilt II and William K. Vanderbilt became NYCRR chairman and chairman of constituent lines respectively upon their father's death. By 1900, Cornelius was dead from a stroke. William renounced his executive responsibilities but remained active on the Board of Directors. The Vanderbilt family remained the major stockholder of NYCRR and its affiliated companies, but it was no longer their private domain by the beginning of the 20th Century.



Above: 1918 route map of the New York Central Lines

53

Part 2

Neither Central or Grand

54

Snook's Folly

55

"...Such railroading demanded a real gateway in New York. In 1860 the plans for a new station, the terminal of the newly amalgamated lines, were completed. There had been a great deal of discussion over the site. Commodore Vanderbilt settled the question by selecting a piece of ground on Forty-second Street. He called the new station the Grand Central because of its accessibility. Its cornerstone was laid on September 13, 1869. As the station began to take shape, New York opened its eyes and gasped. Nothing like it had ever been seen. It had fifteen tracks in its train shed. Some folks said that Commodore Vanderbilt was in his dotage. Others explained the great depot by saying that the Commodore was simply building a terminal that will last for all time..."
The New York Times, February 2nd 1913

56



"People who come to New York should enter a palace on the end of their ride, and not a shed. The stranger who visits us for business or pleasure should be impressed by the magnificence of the great city upon his very entrance within its limits. So we endorse Mr. Vanderbilt's proposed depot on 41st street. Let it be worthy of him and of the metropolis."
Real Estate Record and Guide, June 5th 1869

57



Built at a cost of \$6.4 million and immediately obsolete at the time of its opening in 1871, Grand Central Depot was designed by John Butler Snook (at left, 1815-1901) in association with engineer Isaac C. Buckhout in the French Empire style. It would become the focal point for mid-Manhattan development serving three distinct rail lines;

- New York Central and Hudson River RR
- New York and Harlem RR
- New York, New Haven and Hartford RR

At the depot, each rail line maintained its own waiting room, baggage facilities and ticketing office.

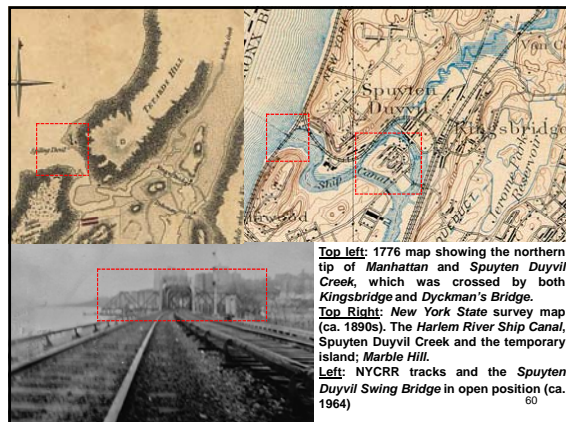
58

The Grand Central Railroad Depot, Harlem Railroad.

Trains will commence running to and from the grand Central Depot, in Fourth Avenue, on Monday, Oct. 9; New-Haven railroad trains on the 16th, and the Central and Hudson River Railroad trains on the 23rd. It is believed that this arrangement will prevent any confusion which might be caused by having the cars of the various lines start on the same day. When trains depart from and arrive at the new depot they will not be allowed to run within a mile of each other, and their movements between the city and Spuyten Duyvil Railroad junction will be regulated by a new system of electrical signals now being arranged. Mr. Joseph H. Franklin, a popular conductor on the New-Haven Railroad for a period of twenty years, has been appointed depot-master on behalf of the New-Haven Railroad Company, and the arrival and departure of all trains of that road will be under his control.

The New York Times, October 1st 1871

59

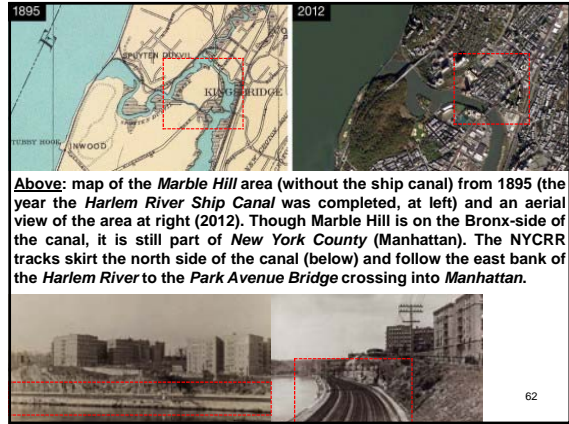


Top Left: 1776 map showing the northern tip of Manhattan and Spuyten Duyvil Creek, which was crossed by both Kingsbridge and Dyckman's Bridge.
 Top Right: New York State survey map (ca. 1890s). The Harlem River Ship Canal, Spuyten Duyvil Creek and the temporary island; Marble Hill.
 Left: NYCRR tracks and the Spuyten Duyvil Swing Bridge in open position (ca. 1964)

60



61



Above: map of the Marble Hill area (without the ship canal) from 1895 (the year the Harlem River Ship Canal was completed, at left) and an aerial view of the area at right (2012). Though Marble Hill is on the Bronx-side of the canal, it is still part of New York County (Manhattan). The NYCRR tracks skirt the north side of the canal (below) and follow the east bank of the Harlem River to the Park Avenue Bridge crossing into Manhattan.

62

Men Who Catch Trains

63

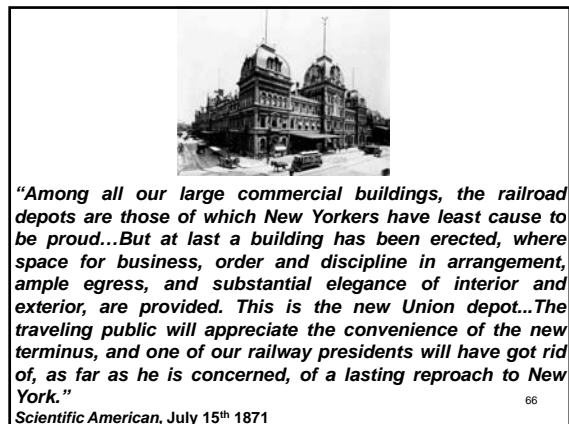
"I must be able to reach my place of business of an hour's time," declared the husband. 'Of course you must,' asserted the wife, 'and we cannot afford to spend all of the difference in rent for railroad fares.'"

RE: excerpt from an 1890 essay appearing in the *New York Times* entitled: *Men Who Catch Trains*. In 1873, the Westchester County villages of Kingsbridge, Morrisania and West Farms were annexed by the City of New York extending the city's north-south axis by sixteen miles and nearly doubling the city's territory. The essay, encouraging settlement in these new parts of the city, pointed out how economical commuting a distance of sixteen miles could be (\$0.09/day).

64

This is the New Union Depot

65



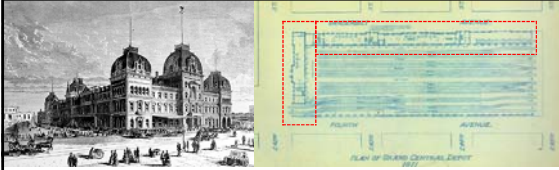
"Among all our large commercial buildings, the railroad depots are those of which New Yorkers have least cause to be proud...But at last a building has been erected, where space for business, order and discipline in arrangement, ample egress, and substantial elegance of interior and exterior, are provided. This is the new Union depot...The traveling public will appreciate the convenience of the new terminus, and one of our railway presidents will have got rid of, as far as he is concerned, of a lasting reproach to New York."

Scientific American, July 15th 1871


66

Head House

67




"One of the first American stations capable of standing comparison with the finest European train stations"
 Carroll L.V. Meeks, Architectural Historian
 RE: with its red pressed brick masonry, ornamental ironwork (painted white to simulate marble) and fenestration along classical lines, *Grand Central Depot* rivaled the facades of European train stations but lacked any rivals this side of the pond. The materials were chosen not only for their aesthetic appeal but also for their fireproof qualities. Akin to London's *Paddington Station*, the L-shaped structure surrounded the train shed. The two legs of the "L" faced south towards *42nd Street* and west towards *Vanderbilt Avenue* (the more affluent sections of the city, at the time). Referred to as the "Head House," at street level all passenger amenities including waiting rooms, ticket offices, restaurants, news stands and restrooms where to be found on the *42nd Street* side (with alternate waiting rooms and baggage facilities on the *Vanderbilt Avenue* side).



"The Mansard Roof, which, since its introduction by Lienau and Marcotte on the house built by Madame Schiff in New York some twenty years ago, has dominated the super-structures of this whole land as completely as the Greek Temple did at one time."
 RE: excerpt from a speech given at the *American Institute of Architects (AIA)* convention, October 1876
 Left: the *Grand Hotel* at *Broadway* and *31st Street* (ca.1870). *Mansard* roofs were an architectural fad at the time.


69



70

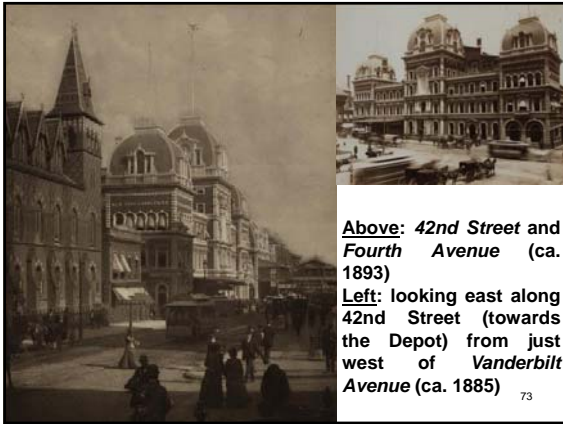
More Cowtown than Continental

71



"Without much pretension to architectural elegance, it is commodious and well adapted to the purposes for which it was designed, and perhaps we ought not to ask much more from a railroad depot...awkwardly up-to-the minute, more cowtown than continental...End of the World Station...can only by a stretch of courtesy be called either central or grand"
 RE: various critiques of the architectural style of the new *Grand Central Depot*

72

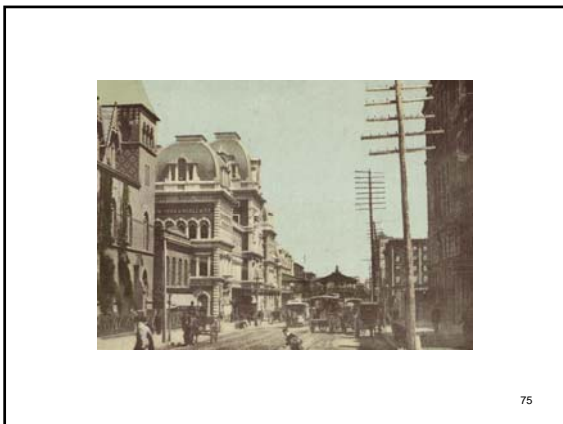


Above: 42nd Street and Fourth Avenue (ca. 1893)
Left: looking east along 42nd Street (towards the Depot) from just west of Vanderbilt Avenue (ca. 1885)

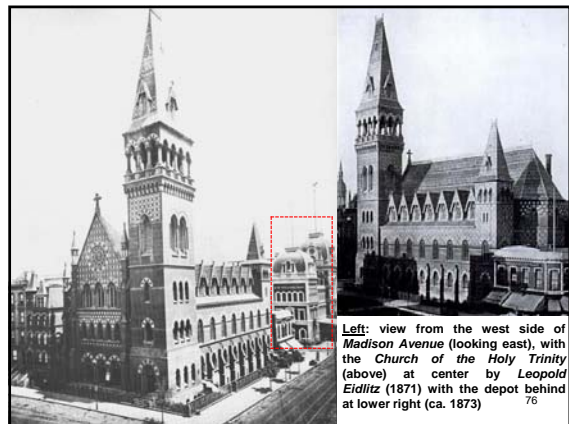
73



74

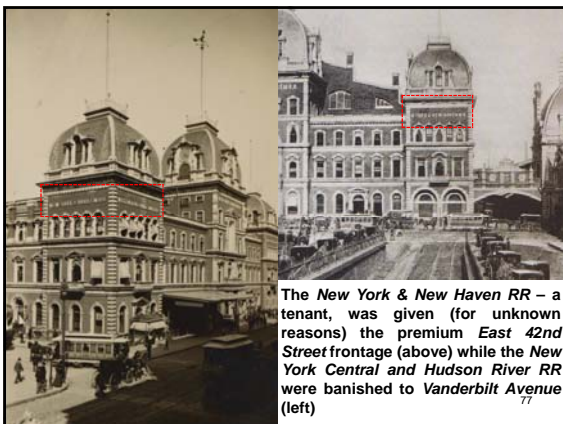


75



Left: view from the west side of Madison Avenue (looking east), with the Church of the Holy Trinity (above) at center by Leopold Eidlitz (1871) with the depot behind at lower right (ca. 1873)

76

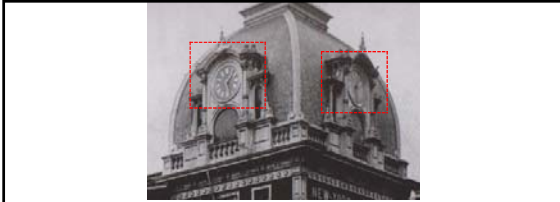


The New York & New Haven RR – a tenant, was given (for unknown reasons) the premium East 42nd Street frontage (above) while the New York Central and Hudson River RR were banished to Vanderbilt Avenue (left)

77

A Singular Event

78



"It was important in connection with railway trains to keep exact time...The condition of the matter was abnormal in numerous instances, there being no less than three hundred points where railroads, using different standards of time, crossed each other and exchanged traffic...On the day when the new standards took effect, the clocks of about twenty thousand railway-stations and the watches of three hundred thousand railway employees were reset. Hundreds, perhaps thousands, of city and town clocks were altered to conform...Probably no such singular incident has ever before happened, or is likely to occur again."

Scientific American, December 20th 1884
 Above: clocks on Grand Central Depot's towers. On November 18th 1883, standard time zones were established across the United States to satisfy the railroad's need to maintain consistent time schedules.

79

Waiting for the Word

80

"Conductors, trainmen, and others are compelled to keep their watches in strict conformity with the superintendent's clock...The time is distributed over the line each week day as follows: At 10 o'clock 58 minutes and 30 seconds A.M. the word 'time' is sent by the main office to the telegraph stations between New York and Albany. The word is repeated for 28 seconds, during which time operators must see that their instruments are adjusted. At 10 o'clock and 50 minutes the seconds commence beating and continue for 50 seconds. The word 'switch' is then sent over the wire, and operators having electric clocks connect them immediately with the circuit known as No. 9 wire. Ten seconds are allowed in which to make the connection. At 11A.M., with one touch of the New York key, the hands of the different clocks are set to 11 o'clock. If they are fast or slow they change at once to the hour named."

Railway World, August 7th 1880

81

In Charge of Time

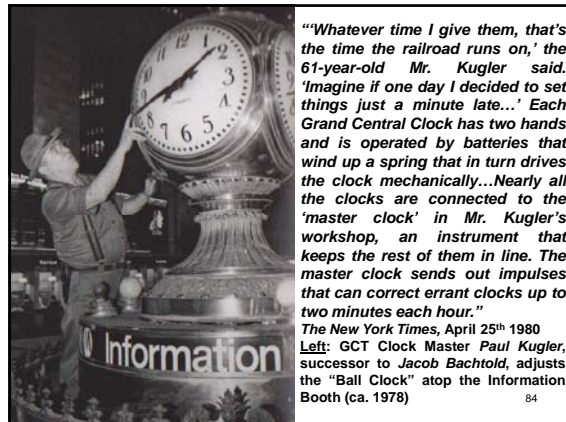
82



"Jacob Bachtold, who is in charge of time in this vicinity for the New York Central. He superintends a thousand clocks...In regulating all clocks, Bachtold depends on a twenty-year-old Hamilton watch...He checks this every morning with a master clock in the train dispatcher's office, which is checked twice a day with the Naval Observatory in Washington...Eventually, after worrying over twelve time clocks used daily by Central employees, he gets around to the grandfather's clock in the office of Frederick E. Williamson, president of the railroad, on the thirty-second floor of the Park Avenue building...He regards clocks as personalities and can tell in advance how they'll go wrong...Clocks have been his life since, as a boy, he was apprenticed to a clockmaker in Switzerland, where he was born. He's sixty-three now, and estimates that he has walked thirty thousand miles inspecting clocks since he went to work for the Central, in 1903. He had only fifty clocks to look after then. Twenty of these are still in use."

Above: "Clock Master" Jacob "Jake the Clock Man" Bachtold checks the accuracy of a clock in GCT (ca. 1950). The Clock Master was/is responsible for maintaining all the clocks throughout GCT.

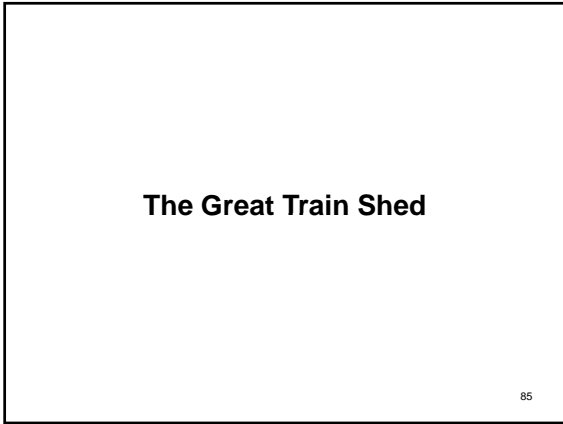
83



"'Whatever time I give them, that's the time the railroad runs on,' the 61-year-old Mr. Kugler said. 'Imagine if one day I decided to set things just a minute late...' Each Grand Central Clock has two hands and is operated by batteries that wind up a spring that in turn drives the clock mechanically...Nearly all the clocks are connected to the 'master clock' in Mr. Kugler's workshop, an instrument that keeps the rest of them in line. The master clock sends out impulses that can correct errant clocks up to two minutes each hour."

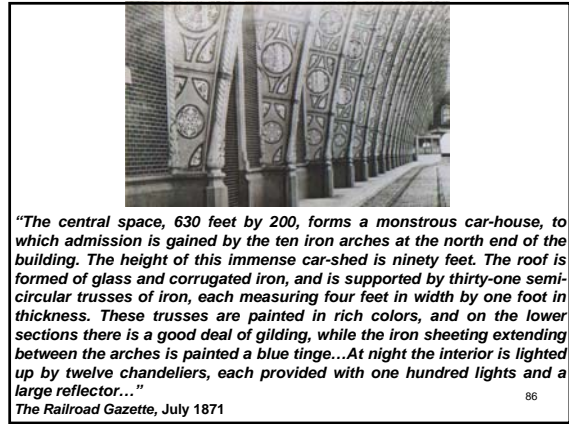
The New York Times, April 25th 1980
 Left: GCT Clock Master Paul Kugler, successor to Jacob Bachtold, adjusts the "Ball Clock" atop the Information Booth (ca. 1978)

84



The Great Train Shed

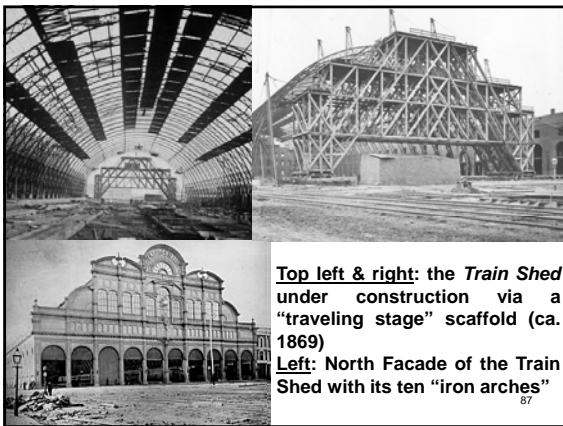
85



"The central space, 630 feet by 200, forms a monstrous car-house, to which admission is gained by the ten iron arches at the north end of the building. The height of this immense car-shed is ninety feet. The roof is formed of glass and corrugated iron, and is supported by thirty-one semi-circular trusses of iron, each measuring four feet in width by one foot in thickness. These trusses are painted in rich colors, and on the lower sections there is a good deal of gilding, while the iron sheeting extending between the arches is painted a blue tinge...At night the interior is lighted up by twelve chandeliers, each provided with one hundred lights and a large reflector..."

The Railroad Gazette, July 1871

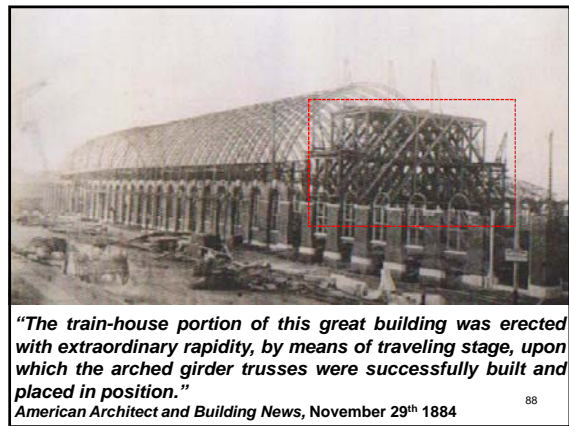
86



Top left & right: the Train Shed under construction via a "traveling stage" scaffold (ca. 1869)

Left: North Facade of the Train Shed with its ten "iron arches"

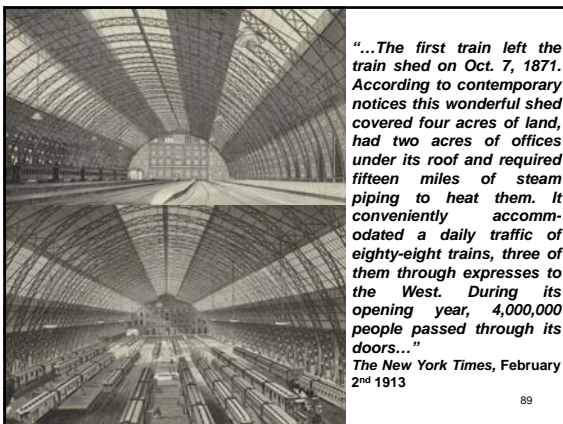
87



"The train-house portion of this great building was erected with extraordinary rapidity, by means of traveling stage, upon which the arched girder trusses were successfully built and placed in position."

American Architect and Building News, November 29th 1884

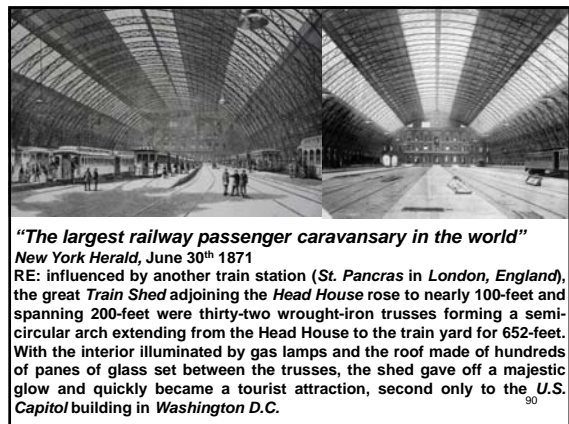
88



"...The first train left the train shed on Oct. 7, 1871. According to contemporary notices this wonderful shed covered four acres of land, had two acres of offices under its roof and required fifteen miles of steam piping to heat them. It conveniently accommodated a daily traffic of eighty-eight trains, three of them through expresses to the West. During its opening year, 4,000,000 people passed through its doors..."

The New York Times, February 2nd 1913

89



"The largest railway passenger caravansary in the world"

New York Herald, June 30th 1871

RE: influenced by another train station (St. Pancras in London, England), the great Train Shed adjoining the Head House rose to nearly 100-feet and spanning 200-feet were thirty-two wrought-iron trusses forming a semi-circular arch extending from the Head House to the train yard for 652-feet. With the interior illuminated by gas lamps and the roof made of hundreds of panes of glass set between the trusses, the shed gave off a majestic glow and quickly became a tourist attraction, second only to the U.S. Capitol building in Washington D.C.

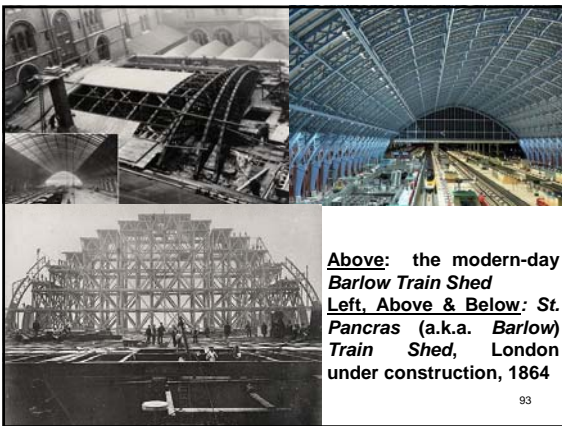
90



91

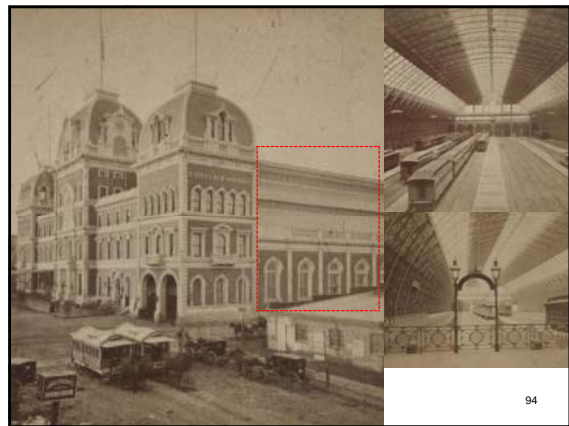
“Occupying, as it does, a site of nearly ten acres, St. Pancras is undoubtedly, if not from an architectural, at least from an engineering point of view, the finest terminus in the world. Its most interesting and peculiar feature is the roof. While it has the widest span of any roof in existence, the space beneath is unbroken by ties or braces, common to all others.”
Scientific American, December 1869
 RE: St. Pancras Station, London

92

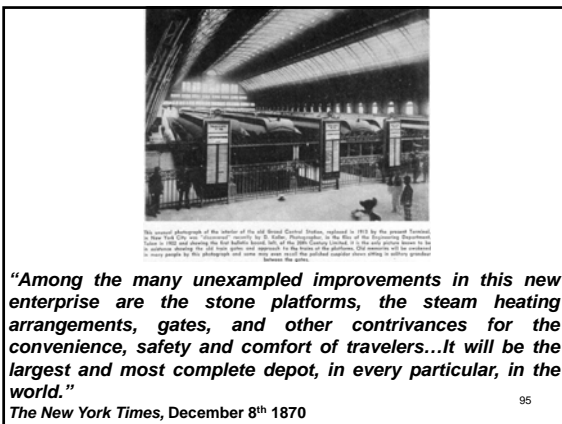


Above: the modern-day Barlow Train Shed
Left, Above & Below: St. Pancras (a.k.a. Barlow) Train Shed, London under construction, 1864

93



94



The largest improvement of the interior of the old Grand Central Station, opened in 1873 by the present building, is the new stone platforms, the steam heating arrangements, gates, and other contrivances for the convenience, safety and comfort of travelers...It will be the largest and most complete depot, in every particular, in the world.

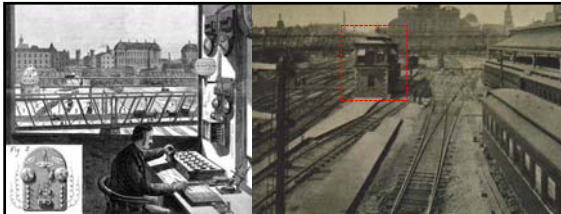
“Among the many unexampled improvements in this new enterprise are the stone platforms, the steam heating arrangements, gates, and other contrivances for the convenience, safety and comfort of travelers...It will be the largest and most complete depot, in every particular, in the world.”

The New York Times, December 8th 1870

95

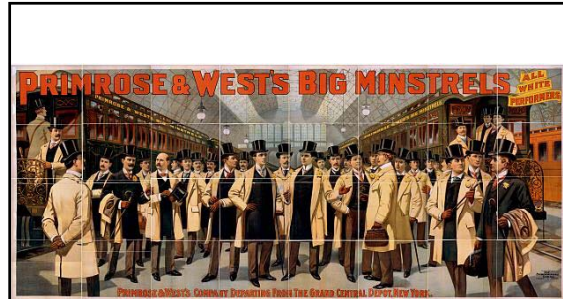


96



"Located far up on the north wall of the depot, the view from its broad window extending over the intricate network of rails is a small cabin...On the wall hang signal indicators and bells, time tables, and a huge clock. On the table before the single occupant are a telegraph instrument, a record book, and three rows of ivory buttons, twenty in all. This is the dispatcher's office, and here, by pressing the buttons or manipulating the telegraph key, he controls the movement of every train going or coming, the buttons, through simple electric bells, governing everything near and about the depot, the key transmitting instructions to far off points."

Scientific American, December 25th 1875
 Above: illustration from *Scientific American* (left) of the Grand Central Depot train dispatcher's office (1875). At right, the Grand Central Depot's yard (ca. 1891). Note the Control Tower (outlined)

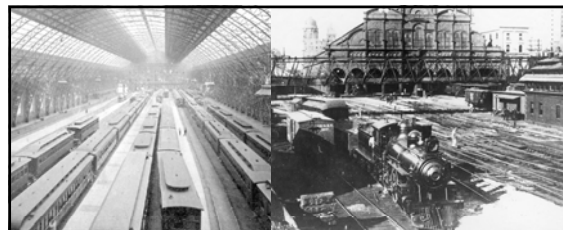


Primrose & West's Big Minstrels at Grand Central Depot (ca. 1897)

98

The Flying Switch

99



During the depot's first full year of operation (1872), its *Train Shed* (inclusive of twelve tracks and seven platforms) handled eighty-five trains per day. Despite its vast size and monumental design, the shed was a dirty place given the steam engines of the day spewing smoke and cinders in the enclosed space. Surfaces were blackened and difficult to keep clean.

100

"While wondering at the speed with which this train approaches the station, you suddenly discover that its locomotive is running alone, and at some distance ahead of its following cars, from which it seems to have broken away. From a certain point the locomotive takes a track that runs outside the station, while from the same point the train follows another line of rails, over which it rolls of its own momentum into the great building. You have witnessed the making of 'a flying switch,' and a very neat one at that."

Harper's Young People, May 23rd 1893

101

"Cornelius Vanderbilt and his immediate successors possessed a laudable devotion to cleanliness, which revealed itself in their aim to keep the station free of smoke"

Carl Condit

RE: the New York Central's engineers; at the insistence of Vanderbilt himself, developed a system of minimizing the pollution generated inside the shed by the steam engines. Called "Flying In" and/or "A Flying Switch," a train approaching the depot would detach the engine (from the cars), accelerate and be directed to a side-track. The forward momentum of the train would allow the cars to "glide" into the depot's yard while the brakeman applied the brakes to bring the engineless train to a safe stop. Egress was easier since the engine was at the head of the train (near the shed's open-end) so smoke and steam exited into the atmosphere rather than the shed. Noise was also kept to a minimum with train whistles only sounded in emergency situations.

102



Inexplicably, the tracks of the *Train Shed* had an unusual, dysfunctional arrangement. Outbound trains left from the west side of the shed while inbound trains arrived on the east side. This defied logic since this track configuration meant that inbound/outbound trains had to cross each other's path thus creating hazardous conditions given the volume of trains and limited visibility from the belching smokestacks of the locomotives. Passengers also complained about the crowded conditions and long trek to the platforms. ¹⁰³

Most Fearful Deathtrap

104

"...most fearful deathtrap...in this now populous quarter, one has to but stand a few minutes in 45th Street, where the cars enter and pass out of the depot, to see the peril to which life is daily put...and to wonder that more people are not wounded or killed for their temerity in attempting a crossing...There is a continued ringing of bells and screaming of whistles that is confusing to the senses, awakened to the possibility of danger from an unknown or unseen quarter..."

The New York Times, 1871

RE: the "no man's land" that was the two block wide nexus of tracks north of *Grand Central*. Besides the smoke, sparks and cinders from the trains themselves, the closely laid surface tracks stymied cross-town traffic and the 600-foot wide train yard interfered with the city's grid plan. Of greater concern to the average *New Yorker* was the danger posed when trying to traverse the tracks (above 45th Street)

105

A Source of Great Public Danger

106

"The Forty-second street depot is simply an enormous nuisance where it stands, a source of great public danger; it cuts the city into two parts, and makes traffic from east to west above Forty-second street a matter of imminent peril to life and limb. And as the Commodore has shown no disposition whatever to be shown to him when the question of public convenience impends. All good citizens, from this time forth, will insist that Commodore Vanderbilt must clear off this island."

Real Estate Record and Builders Guide, February 10th 1872

107

Valley of the Shadow of Death

108

“Cross not Fourth Avenue at the peril of your lives,’ is the dictum of the great Vanderbilt...someone living on East 46th Street near Third Avenue, and wishing to go to 46th Street and Fifth Avenue, has to go to 42nd Street or 49th Street, making a detour of a half mile because this monopoly has made it unsafe to cross at any other point...There is no single thing on New York Island so dangerous to the community and prejudicial to its interests as this Valley of the Shadow of Death, which cuts the city in two its entire length, and stretches, unpaved, ungraded, and is given over to the hundreds of locomotives that continually dash up and down, through the richest district of New York”

RE: myriad sampling of complaints and protests concerning the Grand Central Depot's grade-level tracks

109

A Trip of Daring

110

“...The completion of the Grand Central depot, however, brought no rest for the railroad management. Within after a month after it was finished there was a great public clamor. Several cross streets passed over its approach yards at level; in fact, there were grade crossings all the way north in Fourth Avenue to Eighty-sixth Street. The horse cars in Fifty-ninth Street used to have constant hair breadth escapes at the Fourth Avenue crossing, and that was nothing to the crossing at Forty-fifth Street, at the mouth of the train shed. A driver who took his wagon across those fifteen busy tracks literally took his life in his hands. It was a trip of daring for foot passengers. Beyond the wooden trestle leading down to the Harlem plain there were also many grade crossings before the drawbridge at the Harlem River was reached...”

The New York Times, February 2nd 1913

111

Sink the Track and Arch it Over

112

“...The deaths at the many grade crossings were so frequent that an agitation against the road was started...Mass meetings were held over Harlem, Yorkville, and in the district between Forty-second and Sixty-third Streets, and the watchword was ‘sink the track and arch it over.’ Well known speakers appeared at the meetings, and the agitation grew so rapidly that the whole city was up in arms...”

The New York Times, February 2nd 1913

113

***Sink your tracks, you railroad magnate!
Arch it over well and strong
Do not wait the law's stern mandate
And your nuisance thus prolong***

RE: poem protesting the NYCRR's "juggernaut"

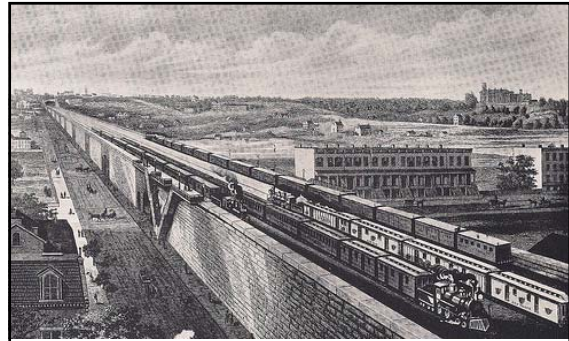
114

"...The railroad was finally compelled to take action, but succeeded in having the city pay one-half of the expense, at which there was little complaint, so anxious were the citizens for the improvement..."

The New York Times, February 2nd 1913

RE: the public outcry combined with the Commodore's desire for his right-of-way to accommodate four rather than two tracks led to a compromise solution. Starting at 45th Street, the grade was lowered and a dozen trestle bridges (connecting the north and south-bound lanes) would span the sunken tracks until 56th Street, where a tunnel commenced below Park Avenue. Between 98th and 116th Streets, a stone viaduct was constructed (due to swampy soil conditions). Construction began in 1872 and concluded two years later, in 1874. Though there were public protests, the City of New York split the cost of sinking the tracks with the NY&HRR.

115



NY&HRR's four-track stone viaduct over the Harlem Flats (ca. 1876). The trains made stops at 86th, 110th and 125th Street/s along the right-of-way.

116

Pity Mr. Vanderbilt

117

"All charitable persons pity Mr. Vanderbilt as a poor man who is compelled to spend his frugal income in lowering the railway tracks in Fourth Avenue, merely in order that the people may not get themselves run over and killed by passing trains...The City of New York was rendered liable, with wonderful legislative promptitude, for the payment of several millions of dollars to assist Commodore Vanderbilt in paying the expenses of partially restoring Fourth Avenue to the public to whom it belongs"

The New York Times, 1874

RE: fearing additional mandates for a safer right-of-way, in 1873 the NYC &HR Railroad proposed to further reduce congestion by tunneling through solid rock all the way up to 96th Street. Iron fences and plots of grass flanked the sunken tracks (vents allowed the train engine's smoke and heat to escape) thus justifying the renaming of Fourth Avenue (north of Grand Central) to Park Avenue.

118

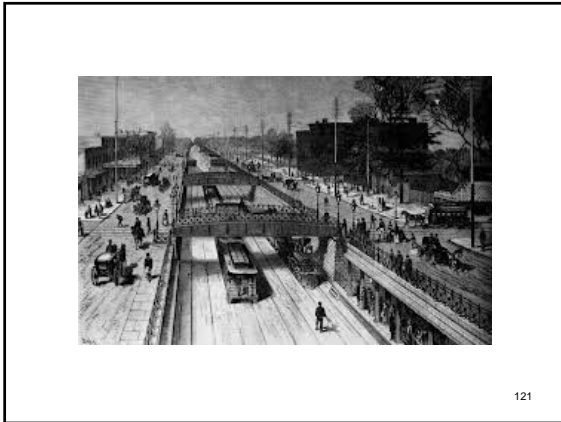
The Underground Railway

119



Left: newspaper article (ca. 1874) concerning the "Beam-Tunnel Operation on Fourth Avenue" (59th to 76th Street/s shown in drawing). It was more commonly referred to a "The Underground Railway."

120



121

"A portion of the new Underground Railway, on Fourth avenue, has just opened for traffic, namely, from Grand Central Depot at 42nd street, northerly to 98th street, over two miles. All trains of the Harlem, Hudson River, and New Haven Companies now run underground, and their withdrawal from surface of Fourth avenue gives great satisfaction to the inhabitants residing on the line. The vibrations produced by the passage of trains is scarcely noticeable in the adjoining houses. The avenue surface above the railway tunnels is now being repaved, and will soon present a most beautiful, attractive appearance. A stranger in passing through this portion of the avenue would be surprised if told that, directly under his feet, the trains of three great railways were flying along at lightning speed."
Scientific American, June 5th 1875

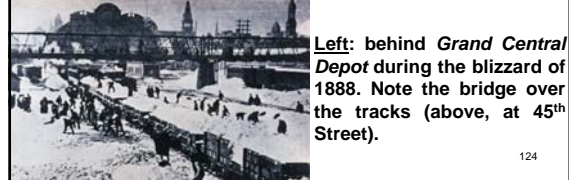
122



Left: the sunken tracks of the "Beam-Tunnel" along Fourth Avenue between 49th and 56th Streets (ca. 1890)

Right: central portion of the Beam-Tunnel underground railway (ca. 1909). The central tunnel had two tracks while adjacent tunnels (on each side) housed a single track. The tunnels were fully brick-enclosed from 67th to 71st Street/s and from 90th to 97th Street/s.

123

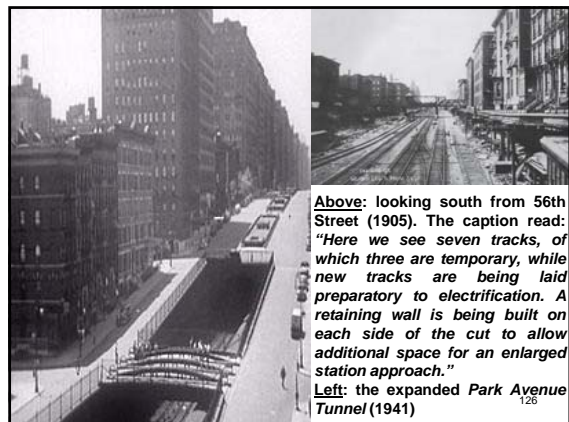


Left: behind Grand Central Depot during the blizzard of 1888. Note the bridge over the tracks (above, at 45th Street).

124

"...seven or eight trains passed without affecting our nervous system. What happens is a short roar and rumble and a puff of white smoke. Some people might mind it very much – to me it would not be in the least disturbing, much less so than the jingle of a cable car, for instance."
 Edith Wharton, Writer
 RE: excerpt from a letter to a friend written in 1896 (she lived in a townhouse on Park Avenue at 78th Street)

125




Above: looking south from 56th Street (1905). The caption read: "Here we see seven tracks, of which three are temporary, while new tracks are being laid preparatory to electrification. A retaining wall is being built on each side of the cut to allow additional space for an enlarged station approach."
Left: the expanded Park Avenue Tunnel (1941)

126

Two Tunnels

127




"...This railroad was partially operated through two tunnels. The first of these cut through the crest of Murray Hill from Thirty-fourth to Forty-first Street. The second was the so-called 'rock tunnel,' extending from about 86th Street to about 100th Street. From it the railroad descended over a timber trestle – about which timid folks were always nervous – to the Harlem plain..."

The New York Times, February 2nd 1913
Above: NY&HRR's Harlem trestle

128

The Park Avenue Improvement

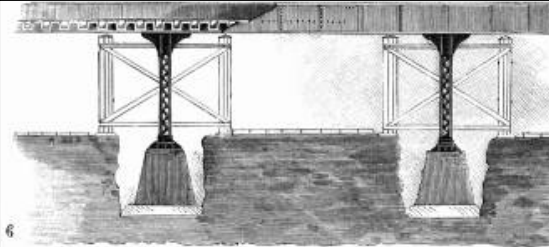
129



"The Grand Central Depot, at the corner of Fourth Avenue and Forty-second Street, in this city, is the main railway terminus on Manhattan Island, it is reached by four tracks on the line of Fourth Avenue, running south from the Harlem River. The tracks start from the street level at the Grand Central Depot, the entire region about the depot being given up to the track yard, round-houses and other structures appertaining to the railroad service. A few blocks above Forty-second Street the streets crossing Fourth Avenue are provided with bridges, but for a space of several blocks Fourth Avenue cannot be crossed. At about Forty-ninth Street the tracks begin to be depressed, and up to Ninety-eighth Street they run virtually in a tunnel, over two miles long. This leaves the street above unencumbered. The avenue is 140 feet wide, and through its center and above the tunnel are a series of little parks, whence the name of Park Avenue has been given to it. Trains passing through the tunnel have an unobstructed track and do not reach the ground level until they get to Ninety-eighth Street. Here the street grade falls rapidly and the car tracks are carried on an elevated viaduct of stone and earth filling. At 106th Street the work of the Park Avenue Improvement Commission begins. It consists in making connections to and in building a four-track elevated steel viaduct from 110th Street to Mott Haven, where the tracks gradually run down to the depressed road in the annexed district (the Bronx). The general aspect of the finished structure is shown in Fig. 3 (above)..."

Scientific American, April 28th 1894

130



"...The way is carried on three rows of lattice steel columns, each row supporting plate girders. The intermediate cross trussing is provided by the flooring, besides which there is a transverse lattice girder for each set of columns. This is arranged on the solid floor system, now in extensive use by the New York Central Road on its bridges. A cross section of it is shown in Fig. 6 (above). It virtually consists of a series of three-sided box girders built up of steel plates and angle irons. The plates are three-eighths inch thickness, and the depth of the vertical plates averages 18 inches with a width of 14 inches. The channels thus formed are open alternately above and below, and cover the entire area with a water-tight floor. From center to center of cross space the distance bridged by the girder floor is 28 feet, giving a total width of floor of 56 feet, a plate girder running along each side and one through the center. The girders are 7 feet 2 inches deep, and the webs are of three-eighths steel for the side and 9-16 for the center girders. From center to center of columns is 65 feet..."

Scientific American, April 28th 1894

131

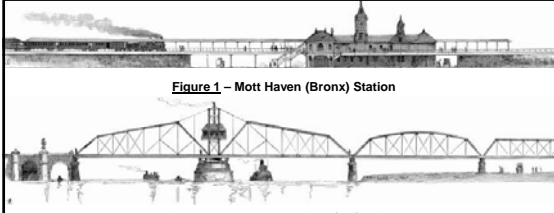


Figure 1 – Mott Haven (Bronx) Station

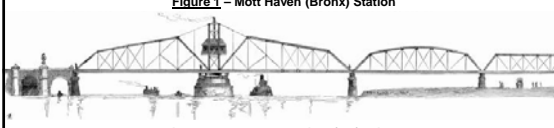


Figure 4 – The Harlem River (RR) Bridge

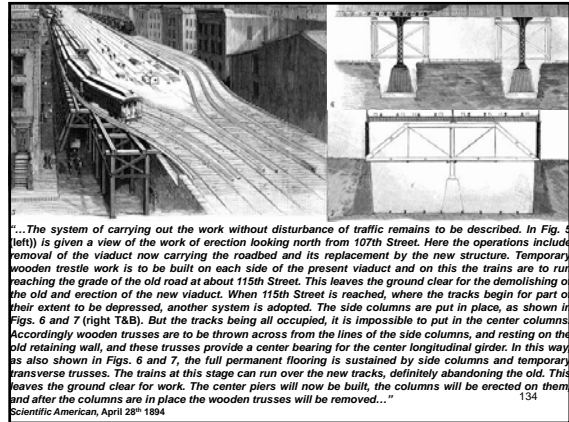
"...The street beneath the viaduct will be graded and paved, and is to be thrown open to the public, leaving the full width, 140 feet between house lines, open and unobstructed, except by the three rows of columns. The Harlem River is to be crossed on a four-track high level bridge, with a center pier drawbridge. Immediately across the river Mott Haven is entered, and here an elevated level station is to be built. The Harlem River bridge is shown in Fig. 4 (above), the Mott Haven station in Fig. 1 (above)..."

Scientific American, April 28th 1894

132

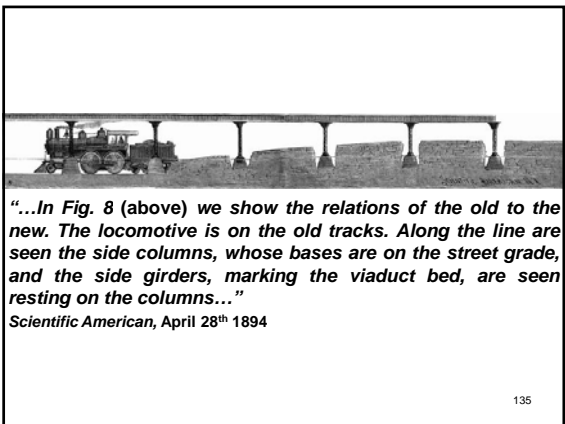
“...One of the purposes in carrying out the improvement is to free the street from the encumbrance presented by the stone viaduct and to do away with bridges at street crossings. This is an object of such importance as to justify the city in paying a part of the expense. The use of an elevated bridge over the Harlem River is also one of the most important features of the work. The river in question is a legal waterway open to navigation. A low drawbridge, such as in use at the present time, is not only an obstacle to vessels, but the necessity for its periodical opening has interfered with the running of the trains. The new bridge is to be so high that the majority of vessels using the Harlem River can pass under it. Thus, while it can be opened, it will be rarely that the necessity for doing so will arise. The bridge, by its high level, will at once improve the conditions of railroad and river traffic...”
 Scientific American, April 28th 1894

133



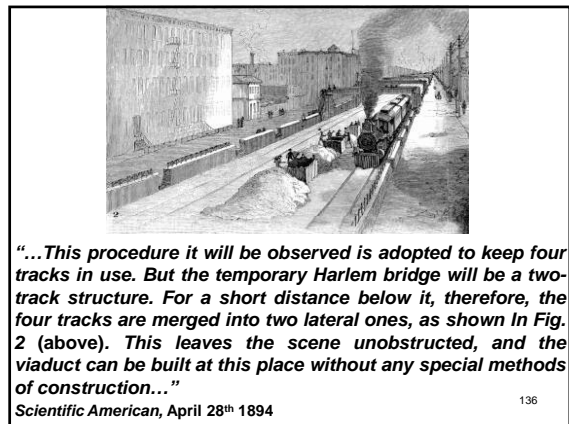
“...The system of carrying out the work without disturbance of traffic remains to be described. In Fig. 5 (left) is given a view of the work of erection looking north from 107th Street. Here the operations include removal of the viaduct now carrying the roadbed and its replacement by the new structure. Temporary wooden trestle work is to be built on each side of the present viaduct and on this the trains are to run reaching the grade of the old road at about 115th Street. This leaves the ground clear for the demolishing of the old and erection of the new viaduct. When 115th Street is reached, where the tracks begin for part of their extent to be depressed, another system is adopted. The side columns are put in place, as shown in Figs. 6 and 7 (right T&S). But the tracks being all occupied, it is impossible to put in the center columns. Accordingly wooden trusses are to be thrown across from the lines of the side columns, and resting on the old retaining wall, and these trusses provide a center bearing for the center longitudinal girder. In this way as also shown in Figs. 6 and 7, the full permanent flooring is sustained by side columns and temporary transverse trusses. The trains at this stage can run over the new tracks, definitely abandoning the old. This leaves the ground clear for work. The center piers will now be built, the columns will be erected on them, and after the columns are in place the wooden trusses will be removed...”
 Scientific American, April 28th 1894

134



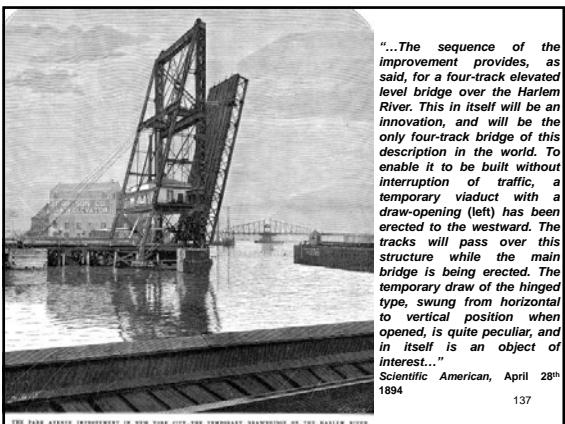
“...In Fig. 8 (above) we show the relations of the old to the new. The locomotive is on the old tracks. Along the line are seen the side columns, whose bases are on the street grade, and the side girders, marking the viaduct bed, are seen resting on the columns...”
 Scientific American, April 28th 1894

135



“...This procedure it will be observed is adopted to keep four tracks in use. But the temporary Harlem bridge will be a two-track structure. For a short distance below it, therefore, the four tracks are merged into two lateral ones, as shown in Fig. 2 (above). This leaves the scene unobstructed, and the viaduct can be built at this place without any special methods of construction...”
 Scientific American, April 28th 1894

136



“...The sequence of the improvement provides, as said, for a four-track elevated level bridge over the Harlem River. This in itself will be an innovation, and will be the only four-track bridge of this description in the world. To enable it to be built without interruption of traffic, a temporary viaduct with a draw-opening (left) has been erected to the westward. The tracks will pass over this structure while the main bridge is being erected. The temporary draw of the hinged type, swung from horizontal to vertical position when opened, is quite peculiar, and in itself is an object of interest...”
 Scientific American, April 28th 1894

137

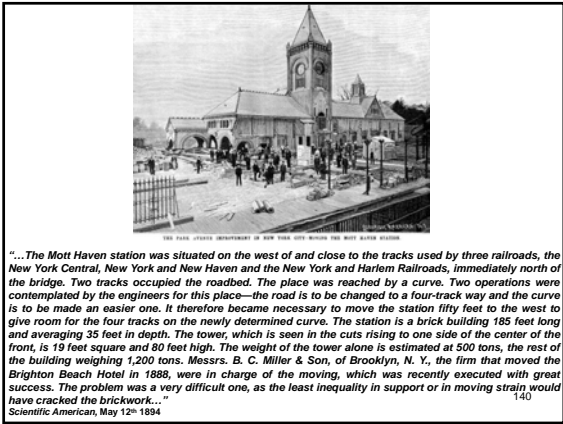


The original low-level railroad bridge across the Harlem River (looking east, towards Mott Haven in the Bronx at left, ca. 1867) was owned by the New York & Harlem Railroad and was also used by the New York & New Haven RR, which used the pair of tracks to access Manhattan. It would be dismantled and replaced by a temporary two-track drawbridge while a four-track, high-level swing bridge was constructed in the 1890s.

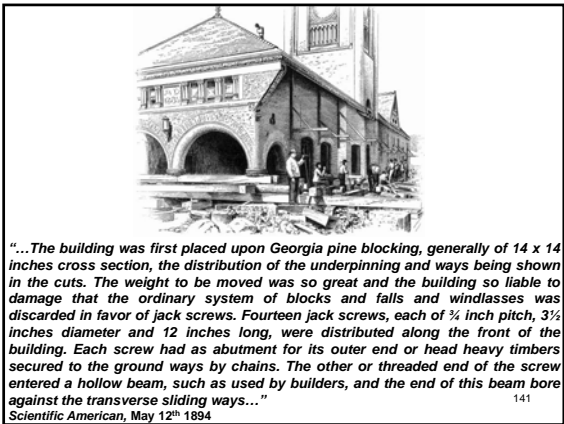
138

The Mott Haven Station

139

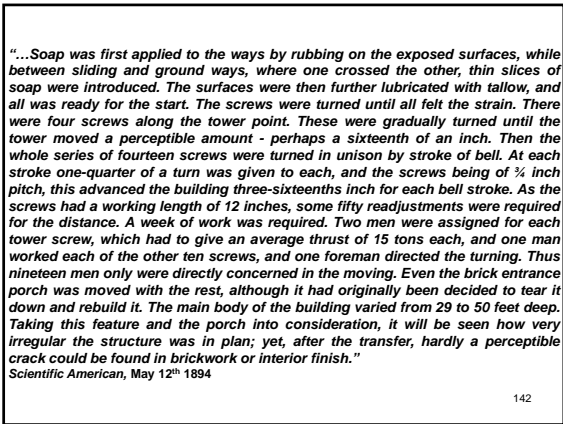


"...The Mott Haven station was situated on the west of and close to the tracks used by three railroads, the New York Central, New York and New Haven and the New York and Harlem Railroads, immediately north of the bridge. Two tracks occupied the roadbed. The place was reached by a curve. Two operations were contemplated by the engineers for this place—the road is to be changed to a four-track way and the curve is to be made an easier one. It therefore became necessary to move the station fifty feet to the west to give room for the four tracks on the newly determined curve. The station is a brick building 185 feet long and averaging 35 feet in depth. The tower, which is seen in the cuts rising to one side of the center of the front, is 19 feet square and 80 feet high. The weight of the tower alone is estimated at 500 tons, the rest of the building weighing 1,200 tons. Messrs. B. C. Miller & Son, of Brooklyn, N. Y., the firm that moved the Brighton Beach Hotel in 1888, were in charge of the moving, which was recently executed with great success. The problem was a very difficult one, as the least inequality in support or in moving strain would have cracked the brickwork..."
 Scientific American, May 12th 1894



"...The building was first placed upon Georgia pine blocking, generally of 14 x 14 inches cross section, the distribution of the underpinning and ways being shown in the cuts. The weight to be moved was so great and the building so liable to damage that the ordinary system of blocks and falls and windlasses was discarded in favor of jack screws. Fourteen jack screws, each of 3/4 inch pitch, 3 1/2 inches diameter and 12 inches long, were distributed along the front of the building. Each screw had as abutment for its outer end or head heavy timbers secured to the ground ways by chains. The other or threaded end of the screw entered a hollow beam, such as was used by builders, and the end of this beam bore against the transverse sliding ways..."
 Scientific American, May 12th 1894

141



"...Soap was first applied to the ways by rubbing on the exposed surfaces, while between sliding and ground ways, where one crossed the other, thin slices of soap were introduced. The surfaces were then further lubricated with tallow, and all was ready for the start. The screws were turned until all felt the strain. There were four screws along the tower point. These were gradually turned until the tower moved a perceptible amount - perhaps a sixteenth of an inch. Then the whole series of fourteen screws were turned in unison by stroke of bell. At each stroke one-quarter of a turn was given to each, and the screws being of 3/4 inch pitch, this advanced the building three-sixteenths inch for each bell stroke. As the screws had a working length of 12 inches, some fifty readjustments were required for the distance. A week of work was required. Two men were assigned for each tower screw, which had to give an average thrust of 15 tons each, and one man worked each of the other ten screws, and one foreman directed the turning. Thus nineteen men only were directly concerned in the moving. Even the brick entrance porch was moved with the rest, although it had originally been decided to tear it down and rebuild it. The main body of the building varied from 29 to 50 feet deep. Taking this feature and the porch into consideration, it will be seen how very irregular the structure was in plan; yet, after the transfer, hardly a perceptible crack could be found in brickwork or interior finish."
 Scientific American, May 12th 1894

142



The 97th Street tunnel portal, looking south - present-day (left). Between 97th and 99th Street/s, the tunnel emerges onto the Harlem viaduct (right) to the Park Avenue Lift Bridge which carries four tracks across the Harlem River into the Bronx and points north of New York City.

143



By 1888 (with all the tracks below grade) the right-of-way extended to the Park Avenue/NY&HRR Bridge over the Harlem River (1890s high-level swing bridge at left, present-day lift bridge above)

144



GRAND UNION HOTEL
 Opposite GRAND CENTRAL DEPOT,
 NEW YORK CITY.
 FORD & CO., Proprietors.

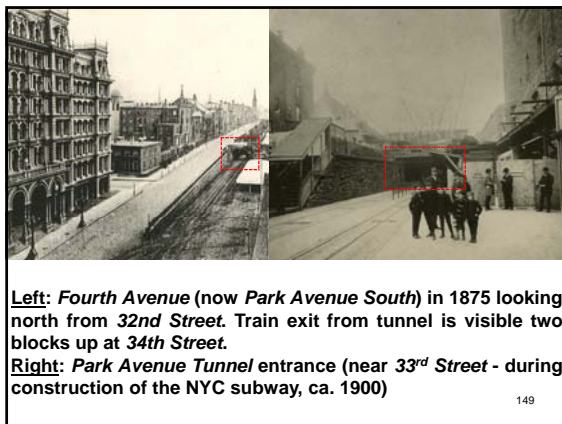
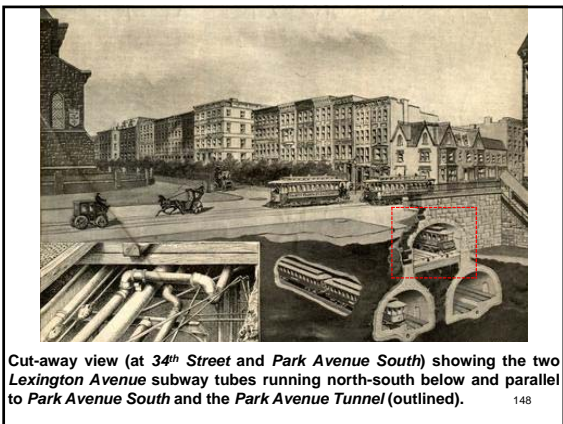
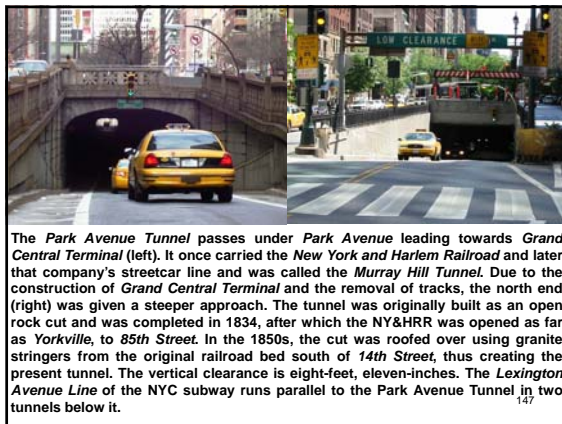
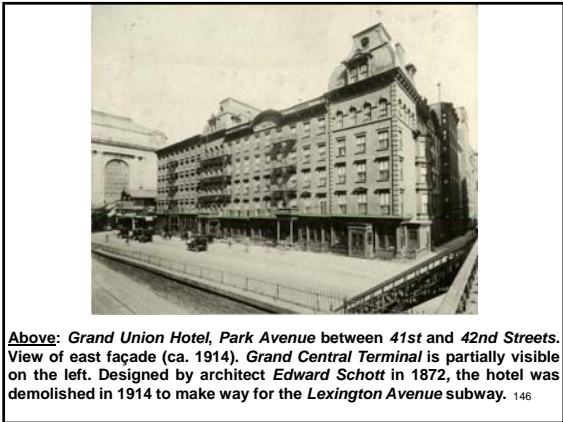
HOTELS may change greatly in one year's time; in two years they are often completely transformed. Every traveler recognizes this fact. The

GRAND UNION HOTEL
 (4th Ave., 41st and 42nd Streets, opposite Grand Central Depot)
 has been steadily improved during the last decade, until it stands to-day as the leading family and tourist hotel of moderate cost in the city of New York.

Abundant Cleanliness - Cuisine Unsurpassed - Telegraph and Long Distance Telephone in Rooms - Elevated Railroad just across the Street - Steam-cars to All Parts of the City - Central Location - Right in the Heart of the Shopping and Business - Equipped for and from and Street Depot Free - Every Attention to Comfort.

Rooms from \$1.00 a Day upward.

Grand Central Depot, view (above) from the south (with the open tracks dug down into Fourth Avenue (later Park Avenue South)). The name Park Avenue was first applied to the stretch extending from 34th Street to 40th Street/s in Murray Hill in the 1850s. In 1867, this stretch extended to 42nd Street. The Union Hotel (left) between 41st and 42nd Street/s on Fourth Avenue was conveniently located opposite Grand Central Depot.



The Fuel Factory

Hotel Belmont
New York City

"How beautiful is this hotel! The atmosphere is so warm and cozy, and the many beautiful rooms are so comfortable..."

Mamma, we will always come to this Hotel, won't we?

WHY, yes, Edith, indeed we will; it is really most delightful every time and with everyone as attentive your papa is perfectly content to have us come here often as you wish. Here, Alice and Mavis and Uncle Dick make the Belmont their home you know.

Go? this is some dandy Hotel, all right. Dad says so, too.

YES, W. Belmont is all very wonderful and so handy to everywhere. Papa says the service is perfect and that there's something about the Belmont he can't find anywhere else. He really ought to know.

By special delivery you may get any of our many fine and rare delicacies from the Belmont.

HOTEL BELMONT
Fourth Street at Park Avenue
Telephone Central 6-1000
NEW YORK

S. L. M. Books, Advertising Division

"...A picturesque annex of the original Grand Central was the Commodore's fuel factory. It was next to a stable that stood where the Hotel Belmont now towers, and consisted of a treadmill operated by horses. This mill cut the wood used in the New York Central's locomotive's. To keep the horses at their drudgery a wisp of hay was hung in front of each one. Now and then the men in charge of the horses would give them a nibble to keep up their appetite..."

The New York Times, February 2nd 1913

Below: plan of a horse-driven mill

Top Right: section through mill

"...One day the Commodore stopped in at his fuel mill. The hay device interested him immensely. As he turned to leave he said to one of the men in charge: 'You'll have to see that you don't run out of hay here. If you should my railroad would go out of business!'"

The New York Times, February 2nd 1913

Above: horse-drawn street car (ca. 1870s). Horses were used to pull streetcars south of 42nd Street through the Park Avenue Tunnel (between 33rd and 41st Streets). A stable capable of accommodating over nine-hundred horses was located on Fourth Avenue (between 32nd and 33rd Streets). Steam locomotives ran north of 42nd Street and horses were used to power the sawmills that produced wood fuel for the engines. This "fuel factory" (and a storage yard for railcars) was located on land owned by the NY&HRR that became part of the consolidated site of Grand Central Depot.

153

Above: auction lot map of 36th and 37th Street/s between Madison and Park Avenue/s (ca. 1860s)

154

Park Avenue South, looking north from 38th Street. GCT and the New York Central Building visible beyond (ca. 1930s)

155

Part 3

Lebensraum

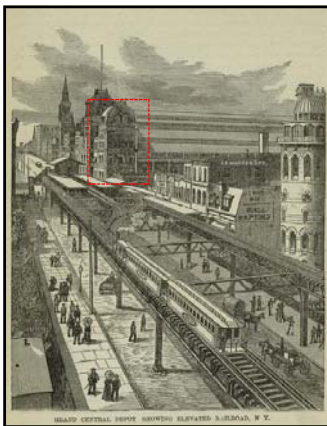
156

The Annex

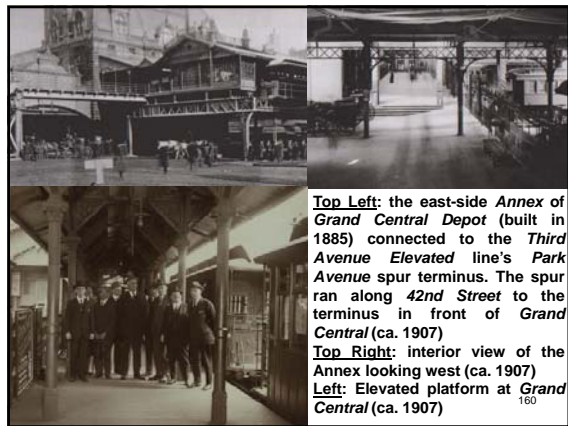
157

"The general public little appreciates the work imposed on Railroad officials in handling a passenger traffic that has grown beyond the facilities of the station where it is received. Travelers will rejoice, along with the station and train men of the New York Central Railroad, at the prospect of an addition to the Grand Central Depot which will practically double the facilities and capacity of the present building."
New York Tribune, February 19th 1884

158



Left: illustration looking west toward Grand Central Depot (down 42nd Street) with the terminus of the Third Avenue Elevated (a.k.a. "L") spur and Annex connection (ca. 1889). Under pressure for increased capacity, the 1885 Annex added seven tracks (on five platforms) to the depot's existing twelve tracks. Even this expansion would prove insufficient in the years ahead. 159



Top Left: the east-side Annex of Grand Central Depot (built in 1885) connected to the Third Avenue Elevated line's Park Avenue spur terminus. The spur ran along 42nd Street to the terminus in front of Grand Central (ca. 1907)
Top Right: interior view of the Annex looking west (ca. 1907)
Left: Elevated platform at Grand Central (ca. 1907) 160

A Sizable Traffic

161

"...By the beginning of the eighties the terminal was again in a state of congestion. The suburban business had become a sizable traffic. The station was clogged morning and night, and so the annex, which gave four additional tracks to it and provided for most of the incoming traffic, was built in 1884. But it was not many years before complaints began to be heard again, complaints against the old waiting rooms and the general facilities for handling passengers..."
The New York Times, February 2nd 1913

162

"The Grand Central yard is now one of the most crowded in the country...The number of trains here are so great that even with a considerable amelioration of the conditions, the yard movements will still be very heavy. Engines are flying around in so many directions that injuries to employees are somewhat frequent, and no financial obstacles should stand in the way of the substantial abatement of the confusion now existing."

The Railway Gazette

RE: from 1871 to the end of the century, patronage of *Grand Central Depot* increased by 400% with three-hundred trains operating in and out of the depot daily. High-speed trains such as the *Empire State Express* and clever marketing no doubt played a part in the expansion and name recognition of the NY&HRR, but the fact was the depot (also the NY&HRR headquarters) could not handle the volume of trains any longer and expansion became imperative.

163



Above: "The Steam Locomotive Speed King" - New York Central & Hudson River Railroad locomotive No.999 on *The Empire State Express*. This locomotive ran at a speed of 112 mph on May 10th 1893. It was the first steam-powered locomotive to operate in excess of 100mph.

164



Above: the *New York Central* was very proud of its *Empire State Express* (bottom right), the legendary train that set an American rail speed record of 112.5 mph with *Engine No. 999* (top right) in 1893. The railroad was in the process of re-equipping many of their flagship trains through the late 1930s and early 1940s with brand-new lightweight, streamlined trains. The *Empire State Express* was no exception and the new train debuted with great fanfare on December 7th 1941 (left), but the event was overshadowed by more important news of the day). A few of the cars from the *Empire State Express* survived and were not retired until the mid-1980s with a select few sold to railroad museums in upstate *New York*.

165



"...As a result of these complaints, in 1900 the station was enlarged to accommodate 60,000 passengers daily. The number of tracks was increased and three stories were added to the building. These changes cost over \$2,500,000..."

The New York Times, February 2nd 1913

Above: caption: "Elevation of Reconstructed *Grand Central Station*, *New York City*"

166

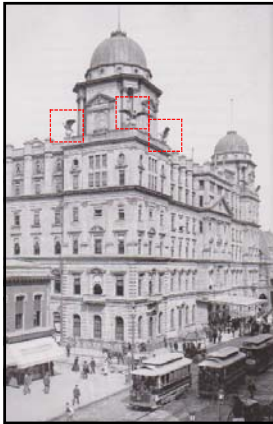
Hardly a Trace

"Though the station is not to be pulled down, so far as appearances will go it might just as well be, for all the old towers will be destroyed and the mansard roof taken away, and four stories of red brick and granite composition are to rise on the two stories left standing. Hardly a trace of the old building will seem to remain."

New York Tribune, October 3rd 1897

167

168

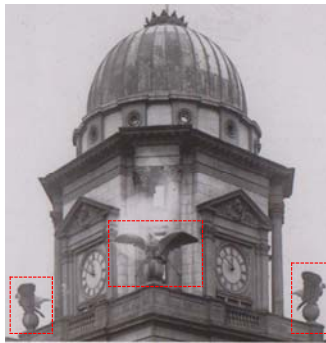


In 1898, three floors were added to the *Head House* (as part of the first phase of depot expansion and renovation) raising the facade to 150-foot above street level. Architect *Bradford Lee Gilbert* chose a *French Renaissance* style for the new facade/s, removing the center tower from the *42nd Street* elevation and converting the remaining mansard roof towers to classical "Tourelles" with decorative nine-foot high "Eagles" atop the towers. New fenestration, facade materials and an entrance pavilion gave the station an entirely new, sophisticated elegance that was widely praised. One other important change was made. No longer would it be called "Grand Central Depot," for now on it was to be *Grand Central Station*.

169



170



171

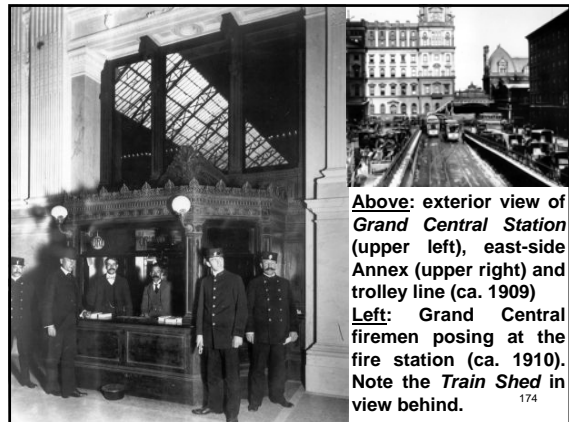


Distinctive ornamentation by Gilbert included cast-iron eagles (above) with a wing-span of thirteen feet. One was restored and can be seen on the corner of *42nd Street* and *Vanderbilt Avenue* (above & left).

172



173

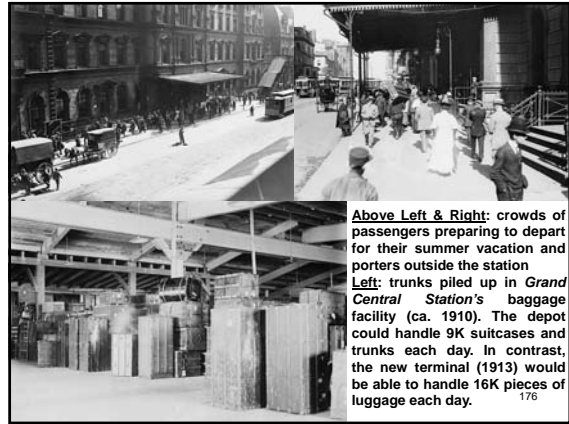


Above: exterior view of *Grand Central Station* (upper left), east-side Annex (upper right) and trolley line (ca. 1909)
 Left: *Grand Central* firemen posing at the fire station (ca. 1910). Note the *Train Shed* in view behind.

174



Above: a cutaway of *Grand Central Depot* showing the plan for new subway tracks below (ca. 1901). In 1899, the entire facade of the depot was rebuilt expanding it from three to six stories. 175



Above Left & Right: crowds of passengers preparing to depart for their summer vacation and porters outside the station
 Left: trunks piled up in *Grand Central Station's* baggage facility (ca. 1910). The depot could handle 9K suitcases and trunks each day. In contrast, the new terminal (1913) would be able to handle 16K pieces of luggage each day. 176

The Taming of the Crowd

177

"It is a remarkable fact that although New York is the second largest city in the world it has but one railroad terminal station within its boundaries...The enormous volume of traffic which Grand Central Station has to accommodate has for many years proved too much for the capacity of the station yard"
Scientific American, December 1900
 RE: the updated station also included many interior refinements. A year after *Bradford Gilbert* (architect of NYC's first skyscraper; the *Tower Building* of 1889) completed the exterior changes, architect *Samuel Huckle, Jr.* began work on the interiors. 178

"...has considerable terrors, for which every way the eye turns, a brazen Moloch comes snorting and puffing, ready to crush out the life and hurl away the mangled body of the unwary or the frightened...One among numerous witnesses attesting to the inconveniences and outrages suffered at the Grand Central Depot stated that the passengers 'are passed in like hogs. Just before the train starts—sometimes only ten minutes, the doors are opened and there is a scramble pell mell. Hats are knocked off, people kicked in the shins, trampled on the toes and pushed this way and that. I have seen women treated shamefully in that way. I have known them to be left-behind for two trains after they have been waiting a whole hour, but could not get through the gate...'"
The New York Times
 RE: the original interior of the depot did nothing to manage the crowd which mimicked their erratic patterns of movement on the street. In the depot, where passengers were confronted with the powerful and dangerous locomotives, it was necessary to impose a means of crowd control that was effective and as inconspicuous as possible. 179

An Ordeal So Dreadful

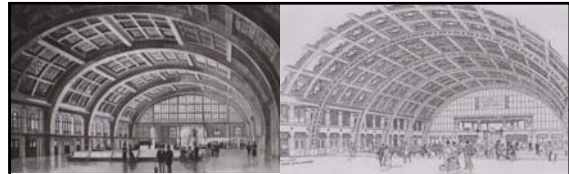
180

"The waiting rooms constituted an ordeal hardly second to that of the tunnel itself, a waiting in rooms crowded to the limit, heated to more than the temperature of the outer air and not ventilated at all...It was an ordeal so dreadful that the experienced shirked it at almost any risk"

The New York Times

RE: the original, individual waiting rooms of Grand Central Depot

181



"New York is to at last have a genuine 'Union' station...instead of three cramped waiting rooms, separated from each other by brick walls, there will be one spacious, high-ceiled, properly lighted modern waiting room, wherein travelers bound eastward, westward, or northward may buy their tickets..."

The New York Times, August 30th 1897

Above: caption: "The General Waiting Room – The Largest in the World – Looking Northeast" The illustration of Bradford Gilbert's barrel-vaulted waiting room (left) appeared in Harper's Weekly in 1897. It was very similar to Gilbert's 1892 design for the Rotunda of Chicago's Illinois Central Station (right).

182



Above: renderings by architect Bradford Gilbert of the new Grand Central Station, (1897);

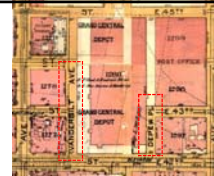
Top - bird's-eye view of the remodeled station (from the balcony of the Manhattan Hotel)

Lower Left - east-end of the general waiting room

Lower Middle - a corner in the women's room

Lower Right - the general waiting room

183



In 1900, Huckle created a "unified" waiting room replacing the three individual, separate waiting rooms into one great hall measuring 100-feet by 200-feet with a 50-foot high vaulted ceiling (precursor of the waiting room to come in the new terminal) featuring rocking chairs and fireplaces. A Rotunda flanked by consolidated, centralized ticket counters with ladies waiting and retiring rooms were part of the new space. An emigrants waiting room (in the Basement): "...relieved the main waiting room and rotunda of this class of passengers." Improved circulation aided "pedestrian flow" (to accommodate the increased passenger traffic). A fifty-foot wide passenger concourse between Vanderbilt Avenue and Depew Place (named for U.S. Senator and NYCRR president Chauncey M. Depew) connected the waiting rooms and train platforms. Gates were used to separate the concourse from the tracks creating a well-defined transitional space between the street and the trains.

184

"The new waiting room, opening to the public today, will be larger than the three old passenger rooms put together, its dimensions being 200 by 100 feet. As it is nearly 70 feet high and finished entirely in marble and white stucco, with a glass roof, it will be much lighter and more airy than the old rooms, which were noted for their gloomy and generally dismal appearance."

The New York Times, October, 18th 1900

185



Above: Grand Central's new, unified Waiting Room (ca. 1904). Putting people through the same procedures and processes in an orderly manner helped to synchronize the crowd making it more manageable. Gilbert's successor; Samuel Huckle, Jr., revised the uniform waiting room's ceiling to be flat rather than the barrel vault Gilbert proposed in 1897.

186

"Anybody could before that have admired the spaciousness of the new arrangement, but nobody could have said with authority whether it was or was not adequate to its purpose"

The New York Times, 1901

RE: at 16K square-feet, the renovated *Grand Central* had the largest RR station waiting room in the world, exceeding Boston's *South Union Station* by 1K square-feet. Even so, by 1901 the volume of trains handled each day had increased three-fold from the early 1870s.

187

The Black Hole of Calcutta

188

"...Yet these facilities, imposing as they seemed at the start, soon proved inadequate. There were many reasons. On was, of course, the rapid increase of population in New York and vicinity. Another, and perhaps most important, was the immense growth of the suburban traffic. More than a million commuters come into New York every morning from points within a radius of twenty-five miles, and a considerable part of this human stream pours through Grand Central. It must be handled quickly and without interference with the through business...To the congestion of traffic was the added discomfort from the use of steam engines. This was especially obnoxious and dangerous in the tunnel. Sentiment developed for the electrification of the roads using the station..."

The New York Times, February 2nd 1913

189

"The thousands who daily travel through the Park Avenue tunnel on railroad trains are the victims of unspeakable tortures. Let a car with doors and windows tightly closed stand in the burning sun for an hour or two until to its inmost recesses it is quivering with heat, then crowd it full of perspiring humanity, keep the doors and windows closed and drag it through several miles of hot, smoky, gas reeking tunnel, and you will have a pretty effective imitation of the Black Hole of Calcutta. And that is what thousands of people have to endure daily in the heart of the greatest city in the Western Hemisphere, and on one of the greatest, richest and most progressive railroads in the world. It is a state of affairs calculated to arouse mingled feelings of indignation, pity and amazement."

New York Tribune, July 2nd 1901

190

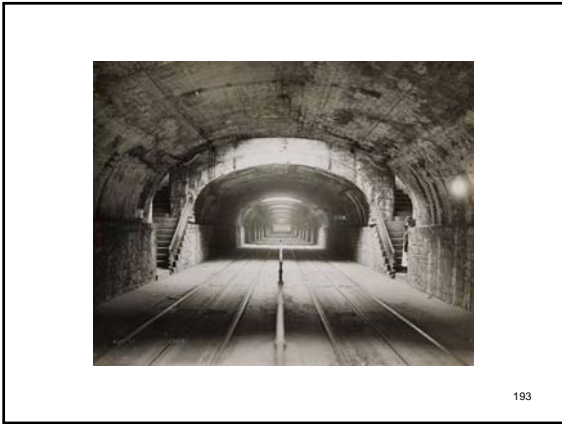
The Daily Tortures

191

"the tortures daily inflicted upon large numbers of persons within the peace of the State of New York by taking them through four miles of the mephitic atmosphere of the tunnel from Grand Central Station to the Harlem River...The work will not be complete until something is done to make traveling through the long Park Avenue tunnel less to be dreaded. In hot summer weather the thought of going through that hole in the ground hangs like a disheartening sword of Damocles over the mind of the poor commuter all day long and burdens his dreams at night. It is not pleasant in winter. But if the locomotive engines between 42nd Street and Mott Haven were driven by electric power and the interior of the tunnel were brightened by paint or kalsomine and illuminated by electricity, the traveler would have nothing more to complain of. The property owners along Park Avenue would be glad too."

The New York Times
RE: 1901 editorial

192



193

Part 4

Catalyst for Change

194

"...In January, 1902, conditions were crystalized by an accident which occurred in the tunnel on a snowy morning, owing to the inability of a train engineer to see signals on account of the smoke from a locomotive ahead..."
The New York Times, February 2nd 1913
 RE: the January 8th 1902 fatal crash in the Park Avenue Tunnel

195

TUNNEL WRECK PARALLELED BY THE DISASTER OF 1891.
 FIFTEEN KILLED, THIRTY-SIX HURT
TUNNEL EVILS CONDEMNED.
 TUNNEL DEATH LIST GROWS
 STEAM SCALDS VICTIMS BURIED IN THE WRECKAGE.
Locomotive Telescopes with Two Rear Cars in Park Avenue Tunnel - Scenes of Horror.

TRAPPED UNDER ENGINE AND ROASTED BY STEAM.
 19 KILLED, 40 HURT IN TUNNEL WRECK.
 ENGINEER DID NOT HEED SIGNALS.
 ENGINEER WISKER HELD CRIMINALLY NEGLIGENT.

INQUIRY INTO DISASTER BEGUN
THE MAYOR BLAMES STEAM
 HE THINKS ELECTRICITY SHOULD BE USED IN TUNNEL-OFFERS HIS SERVICES

NEW-ROCHELLE MOURNING
TUNNEL AT FAULT. EXPERTS FIND.

15 KILLED, 35 INJURED IN N. Y. CENTRAL TUNNEL CRASH

196

"The tunnel, the dreadful smoke-filled tunnel, against which all New York has long stormed and protested, is responsible for the murderous collision of yesterday...the engineer of the Harlem train could not see the signals in the thick atmosphere of the tunnel filled with the steam and smoke. It is unlikely that anybody could have seen them. Having no warning that the train ahead of him had come to a standstill, the Harlem engineer ran as if he had a clear track, and the collision and slaughter resulted."
The New York Times, January 9th 1902

197



198

The Morbidly Minded

199

VICTIMS OF PARK AVENUE TUNNEL DISASTER

VICTIMS OF THE WRECK AT VARIOUS HOSPITALS

"...The scene of the calamity in the tunnel continues to exercise a strange fascination for the morbidly minded. All night long, although there was absolutely nothing to be seen but the bare, dark opening of the tunnel, a curious crowd lingered around the spot and discussed in awe-struck whispers the fatality which had wiped out fifteen lives and injured scores of men and women." 200
The Brooklyn Daily Eagle, Jan. 9th 1902

NEW ROCHELLE GRIEF-STRICKEN.
Dead, Dying, Maimed and Injured Belonged There, and Fifty Families Felt the Horror of the Tunnel Calamity.
ANXIOUS THRONGS AT TELEGRAPH OFFICE.
List of Wives Searched for News of Maimed—May Mined Fatalities Death by Failure to Catch the Train—How Some Lucky Ones Escaped Injury.

IDENTIFYING THE DEAD AT THE POLICE STATION.
Startling Scenes When Friends and Relatives of Victims Called There—Some Had First Walks the Road of the Hospital in Quest of Missing Ones.

HURLED TO CAR ROOF, PINNED BY CUSHIONS.
Young George Fawcett's Escape from Locked Death—List of Struck—Holding Stories Told by Survivors.

201



"This stricken city, although still in the shadow of grief, has today recovered somewhat from the paralyzing shock of the railway tunnel disaster in New York, and is awakening to a sense of intense indignation. As slowly the harvest of death reaped in the hole under the New York streets is being garnered in the homes of New Rochelle, the townsmen of the dead and the maimed are beginning to ask each other not how this thing occurred, but why...Business in this city, which was suddenly paralyzed yesterday upon receipt of the story of death and mutilation, has not yet been resumed to any extent. It will not be until the undertakers' wagons cease their trips from the little railway station. The telegraphic congestion at the station has been relieved. An army of wives and sisters and parents of those who were injured in the wreck are by this time in New York, scattered about the various hospitals, watching by the bedside of their loved ones, so that today the telegraph gave way in importance to baggage master, whose duty it was to receive the dead...At a meeting of the Taxpayers' Alliance of the Borough of the Bronx, held on Wednesday evening, resolutions were unanimously adopted expressing indignation that the accident in the Park Avenue tunnel should have been possible, and calling upon the officials of the State and city to see to it that those responsible for the disaster be punished and that the railroad company be compelled to take steps to improve their terminal facilities." 203
The New York Times, January 10th 1902

Telescoping

204

"Fifteen persons were killed and two score severely injured as a result of a rear-end collision in the Park Avenue railroad tunnel, at Fifty-sixth Street, yesterday morning at 8:20 o'clock. Unaccountable blunders of an engineer, who disregarded signals, which he says he did not see, are held to be responsible for the accident - the worst railroad disaster that ever occurred on Manhattan Island...That a terrible tragedy had occurred was evident immediately. Above the hissing of escaping steam could be heard shrieks and groans of pain. There was a din of breaking glass and crackling woodwork. The boiler of the engine was inside the wrecked car. Dead and wounded were on each side and in front of this boiler, filled as it was with boiling water and steam. The force of the engines' impact had telescoped the rear car on to the car ahead. The passengers who were sitting in the forward portion of the car, therefore, were pushed backward. Those sitting in the rear were plunged upward and forward. Only a space of some nine feet remained between the headlight of the engine and the platform of the second car...The damage done to those in the rear train and in the forward cars of the Danbury train was largely due to fright. A few were bruised or cut, but many fainted and suffered severe nervous shocks. As soon as could be, the men who maintained presence of mind opened the doors of the other cars and enabled the passengers to alight. The tunnel was so filled with fumes, however, that little could be seen one way or another..."

205

The New York Times, January 9th 1902

"...Most of the death, injury, and damage was wrought by the engine of the White Plains train, which plunged into the rear car of the motionless train and was driven through to the middle of the car, smashing the seats and furnishings and splitting the sides as it moved forward. The victims either were mangled in the mass of wreckage carried at the pilot, crushed in the space between boiler and car sides, or scalded by steam which came from broken pipes and cylinders."


The Chicago Daily Tribune, January 9th 1902

206

"The disregarding of block signals by the engineer of a train was responsible for a collision in the New York Central tunnel today and resulted in the death of fifteen persons and the serious injury of sixteen others, at least two of whom are not expected to survive. John Wisker, the engineer is under arrest, bail being refused, pending full inquiry into the disaster. He is in a state of collapse, and the only explanation he can give is that he was trying to make up lost time when his engine plowed its way through the crowded passenger coach of a train which had stopped in the tunnel..."

The Chicago Daily Tribune, January 9th 1902

207



"I DO NOT THINK IT WAS AN UNAVOIDABLE ACCIDENT."—District Attorney Jerome

John M. Wisker (left) – the engineer driving the train, was put on trial for manslaughter for causing the gruesome tunnel crash which occurred on January 8th 1902. From the start, he was blamed for the wreck. Newspapers questioned his experience as an engineer and he was even held in jail for a short time. Newspapers described some victims as boiling to death from the steam of the engine. "Telescoping" was the term used to describe the crash. The force of the crash caused the cars to collapse into one another whereby one car slid inside the one in front of it. On April 25th 1903, Wisker was acquitted. The tunnel had been built in 1876 as part of the remediation of the grade-crossing problem. Low visibility in the darkness and, especially, the smoke from coal-burning locomotives made the tunnel extremely hazardous. Prior to this incident, Park Avenue Tunnel accidents had occurred in 1891 when six people were killed and in 1882, when two people lost their lives.

208

TUNNEL AT FAULT. EXPERTS FIND.

Engineer Wisker to Be Bailed as a Result of Discovery that New York Central Torpedo System Is Defective.

The experimental trip taken on an observation engine through the Grand Central tunnel to-day showed that the smoke and steam obscure signals and that the system of warning engineers by torpedoes is faulty.

In view of all this, Assistant District-Attorney Garvan has reported to District-Attorney Jerome that Engineer Wisker cannot be held for a greater crime than manslaughter.

Mr. Jerome announces that he will not oppose a motion to admit Wisker to \$10,000 bail.

Several of the victims of the accident were buried in New Rochelle to-day. Arrangements are under way for a mass-meeting of the citizens of White Plains, New Rochelle and Mount Vernon to protest against tunnel conditions.

The Assembly will be asked to pass next Monday night a resolution on the disaster. The Board of Aldermen will be asked next Wednesday to order the use of electricity in the tunnel.

To his pastor, the Rev. B. H. Busch, Engineer Wisker said:

"We passed an outgoing train which passed at my right. The smoke fiercely filled the tunnel so that I did not see any green or distance light. I heard no shout from any fireman. As I could not see ahead I thought it best to put on the brakes. I did it for safety's sake. Engineers are expected to get their trains on on time."

209

"District Attorney Jerome continued his official investigation today into causes of the disaster in the New York Central tunnel yesterday afternoon, which caused the death of fifteen persons and injuries to at least forty. A number of employees of the railroad company was summoned by the district Attorney to appear before him..."

The Brooklyn Daily Eagle, January 9th 1902

210

"...As a result a legislative act was passed at Albany requiring the railroads, after a certain date, to operate their trains by electricity through Park Avenue. Now that electrification was mandatory, fresh impetus was given to the plan of reconstructing the terminal. Here we reach the real keynote of the whole project, for without electrically hauled trains the improvement could not have been developed along the broad and original lines that mark it..."

The New York Times, February 2nd 1913

RE: after the January 1902 accident, there were calls for the NYCRR's management to be prosecuted for manslaughter and/or be barred from entering *Manhattan* all together. At the very least, they would be required to use their *Mott Haven* yards in the *South Bronx* as the terminus instead of *Grand Central* if they continued to use steam locomotives. Electric train service was first introduced on a main line of the *Baltimore & Ohio Railroad* in 1895 and in 1899, the NYCRR had contemplated but never implemented an experimental trial of electric trains. Now, in the aftermath of the tunnel calamity, there was a fresh and urgent motivation to replace their steam engines with electric locomotives.

217

A Civilized City

218



Paris is a civilized city...A piece of ground on the river front happened to come into the market, and electrical development, allowing of electrical traction, synchronized with this opportunity. The result is that the railway has built a station which is one of the architectural ornaments of Paris, on the Quai d'Orsay...Would it not be within the financial power of the 'Vanderbilt system' to send a competent electrical engineer out to Paris to find out just how this feat has been performed which the system keeps on repeating is beyond the power of man?"

The New York Times, November 7th 1901

Above: exterior of the Quai d'Orsay Terminal, Orleans Railway, Paris (left) and interior view of platforms with electric locomotives (right)

219

A Tough Act to Follow

220

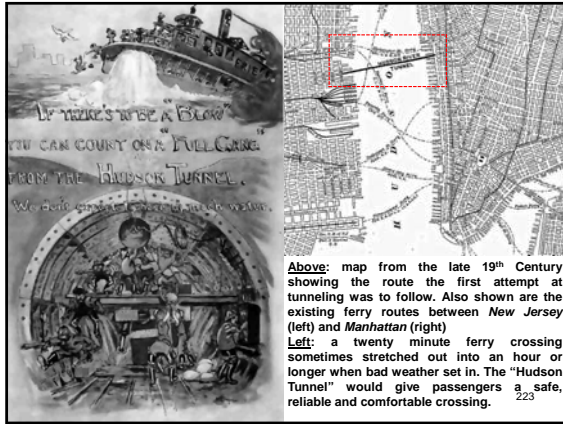


Left: Lower Manhattan, Brooklyn, Hoboken and Jersey City ferry lines (1847). Direct access by train to Manhattan was limited to trains crossing the *Harlem River* from points north of the New York City. The *Brooklyn Bridge* (1883) provided the first train service across the *East River*. Ferries provided the main means of accessing the city from points east, west and south of the city until tunnels connected *New Jersey* and *Long Island* to Manhattan.

221

On December 12th 1901, *Alexander Cassatt* – president of the *Pennsylvania Railroad*, the NYCRR's main competitor for passengers traveling west, announced their plans to tunnel under the *Hudson* (a.k.a. "North") *River* providing direct electric train service into the west-side of Manhattan. The terminus would be a grand, eloquent edifice designed by *McKim, Mead & White* based on the Roman public baths built by *Emperor Caracalla: Pennsylvania Station*. Bounded by *Seventh* and *Eighth Avenue/s* (east-west) and *31st* and *33rd Street/s* (north-south) it would occupy two full city blocks. Tunnels under the *East River* would provide a connection to the *Pennsy's Long Island Railroad* and their *Sunnyside (Long Island City)* train yard. As well, the *New York Connecting Railroad* with its planned tunnel under the *Narrows* (never realized) and *Hell Gate Viaduct/Arch* (1917) would provide passenger train service to the northeast. Opened in 1910, the station and the sets of tunnels cost \$114 million. It was torn down in 1963, sparking the preservation movement.

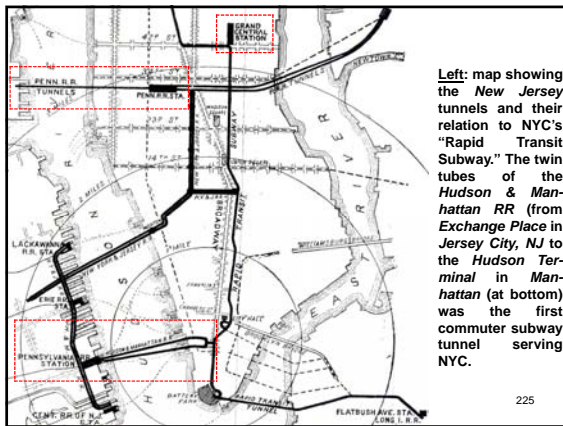
222



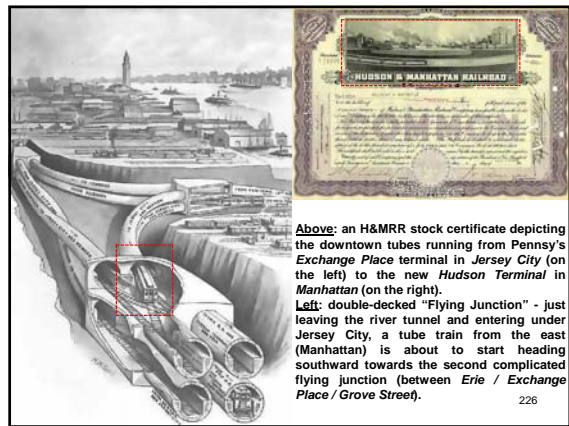
Above: map from the late 19th Century showing the route the first attempt at tunneling was to follow. Also shown are the existing ferry routes between New Jersey (left) and Manhattan (right)
Left: a twenty minute ferry crossing sometimes stretched out into an hour or longer when bad weather set in. The Hudson Tunnel would give passengers a safe, reliable and comfortable crossing.



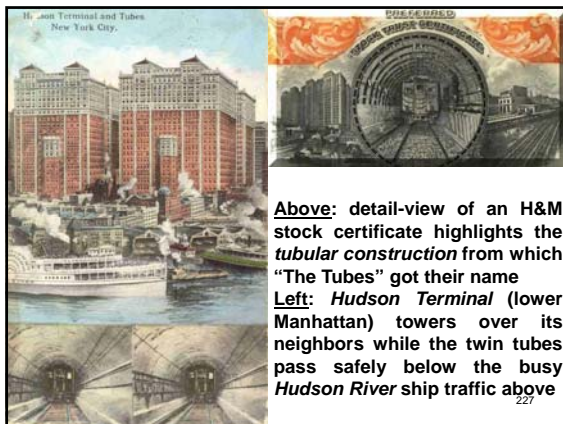
"Port of New York Railroads circa 1900" 224



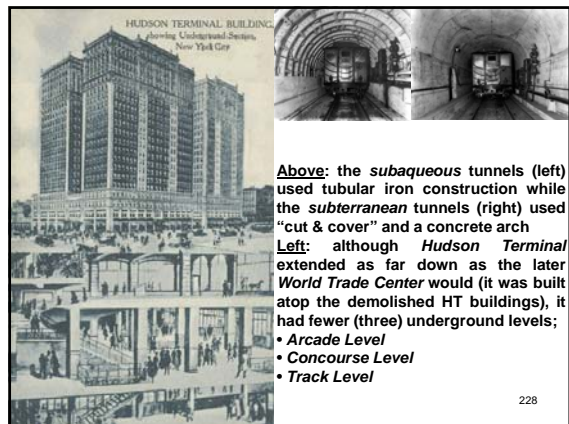
Left: map showing the New Jersey tunnels and their relation to NYC's "Rapid Transit Subway." The twin tubes of the Hudson & Manhattan RR (from Exchange Place in Jersey City, NJ to the Hudson Terminal in Manhattan (at bottom) was the first commuter subway tunnel serving NYC.



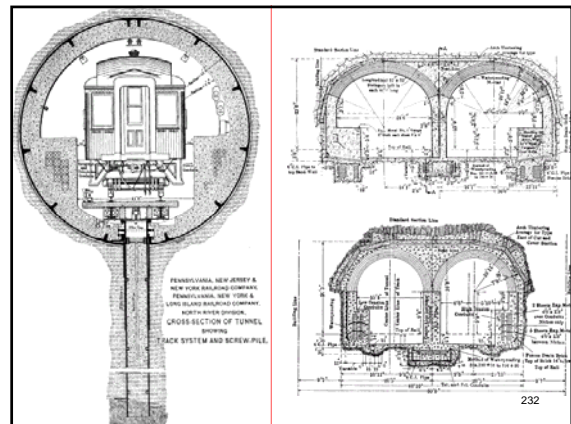
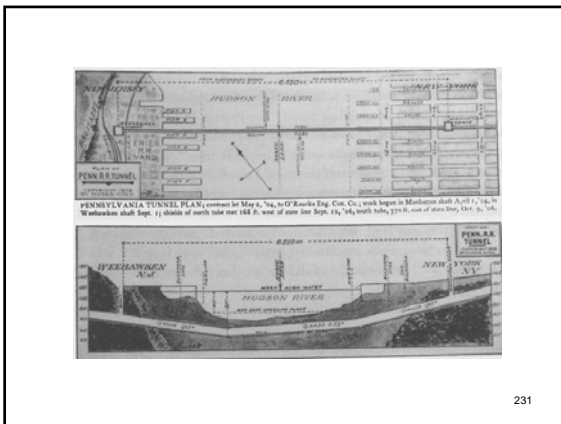
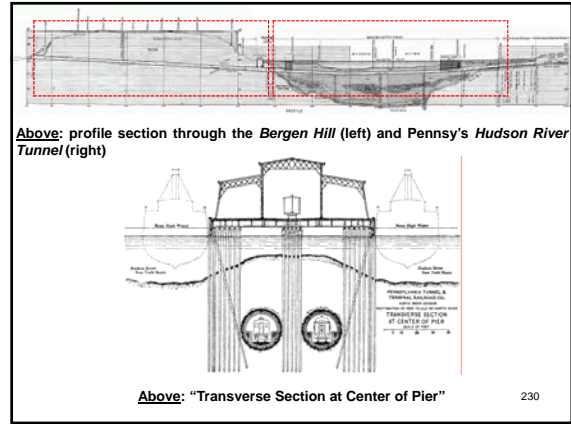
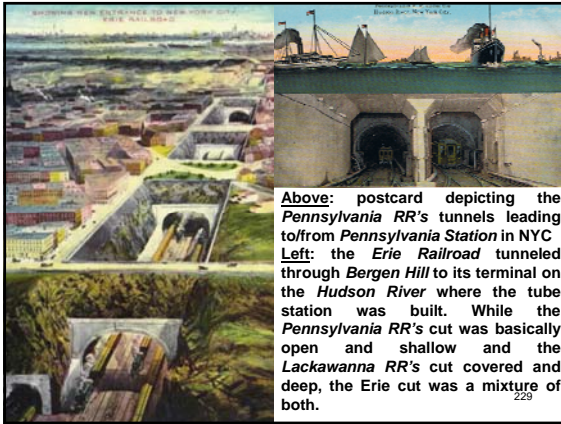
Above: an H&MRR stock certificate depicting the downtown tubes running from Pennys's Exchange Place terminal in Jersey City (on the left) to the new Hudson Terminal in Manhattan (on the right).
Left: double-decked "Flying Junction" - just leaving the river tunnel and entering under Jersey City, a tube train from the east (Manhattan) is about to start heading southward towards the second complicated flying junction (between Erie / Exchange Place / Grove Street).



Above: detail-view of an H&M stock certificate highlights the tubular construction from which "The Tubes" got their name
Left: Hudson Terminal (lower Manhattan) towers over its neighbors while the twin tubes pass safely below the busy Hudson River ship traffic above



Above: the subaqueous tunnels (left) used tubular iron construction while the subterranean tunnels (right) used "cut & cover" and a concrete arch
Left: although Hudson Terminal extended as far down as the later World Trade Center would (it was built atop the demolished HT buildings), it had fewer (three) underground levels;
 • Arcade Level
 • Concourse Level
 • Track Level



THE NEW PENNSYLVANIA STATION
 7th Avenue and 32d Street
 NEW YORK

ONLY ONE BLOCK FROM BROADWAY

In the Heart of New York's Shopping, Theatre, and Hotel District

MIDWAY BETWEEN
THE TIMES and **MADISON SQUARE**

All parts of the site are well arranged. Only a block block away on the Theater-district from the site of the South Avenue Branch and the Hudson and Manhattan tubes. The Pennsylvania Station connects the existing Pennsylvania Station and with all its tracks and facilities from the Hudson at 30th Street and South Avenue.

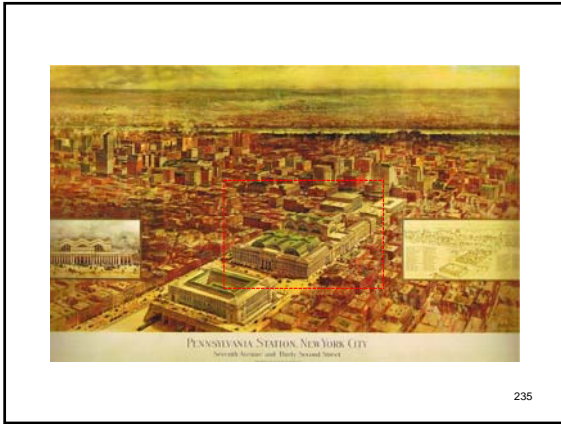
Will be opened November 27

"...The Pennsylvania Railroad on the other hand did not own a foot of land where its terminal rests, and although it purchased real estate in secret, 28 acres of it, it had to pay the land speculators who guessed right a little profit. So in 1902 the management wrote off \$5,000,000, which it considered exorbitant or excess price paid, from the cost of the land purchased..."

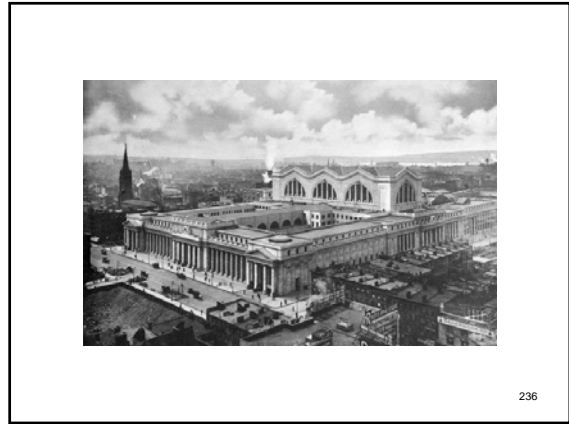
The Wall Street Journal, December 1912

RE: on its twenty-eight acres, sixteen miles of rails converged into twenty-one tracks serving eleven platforms in Pennsylvania Station, New York City

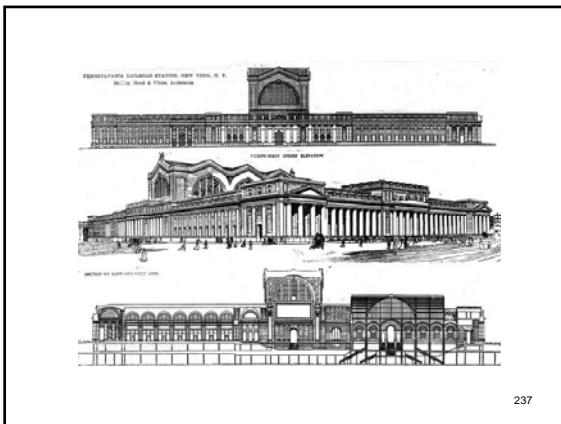
Left: ad for the opening of "The New Pennsylvania Station" (November 27th 1910)



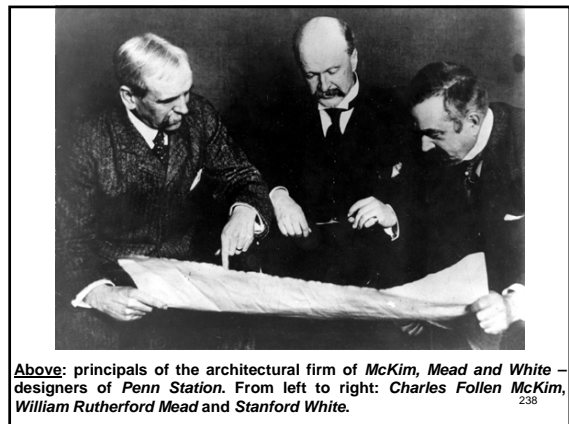
235



236



237



Above: principals of the architectural firm of McKim, Mead and White – designers of Penn Station. From left to right: Charles Follen McKim, William Rutherford Mead and Stanford White.

238

The Pennsy's Big Work

239

“...Today the Pennsylvania Railroad Company, quite the largest of the country's transportation corporations, carries its plant and equipment at a book value of \$403,000,000. Including \$246,700,000 securities of affiliated corporations owned, \$61,700,000 marketable securities and other minor investments. Pennsylvania's property account totals \$727,700,000...by the time \$825,000,000 has been invested in New York tractions Pennsylvania's property and security account will be considerably larger than it is today, Pennsylvania's big work, however, is now for the most part behind it...”
The Wall Street Journal, December 1912

240



241



242



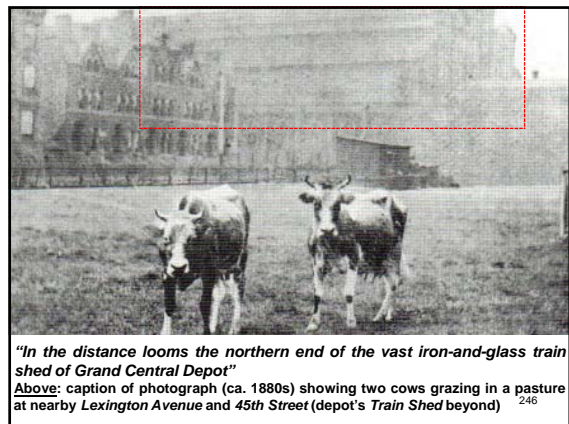
243

Location, Location, Location

244

“When the first Grand Central Station was built it was away uptown; almost, it might be said, in the open country. But being the only station in New York City, it became the center of an active development. The great hotels, amusement places and the retail stores saw an advantage in being within easy reach of it; the famous residence and club district sprang up around it; many of the most beautiful buildings in the city were erected within short distance of it, and thus it is today Grand Central is in the very heart of the district that the visitor to New York wishes most to see, and not, as railroad stations often are, in an obscure or unattractive part of the city.”
Banker’s Magazine, January 1913

245



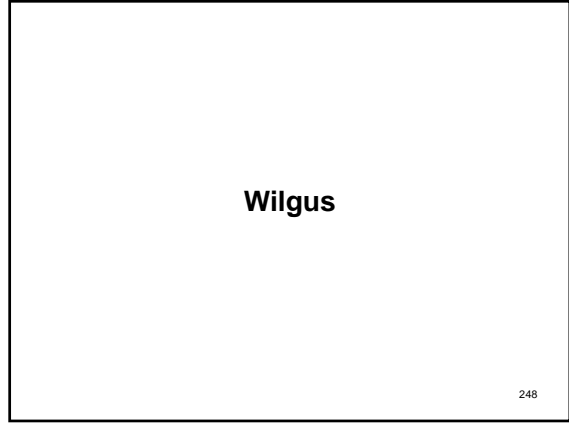
“In the distance looms the northern end of the vast iron-and-glass train shed of Grand Central Depot”
 Above: caption of photograph (ca. 1880s) showing two cows grazing in a pasture at nearby Lexington Avenue and 45th Street (depot’s Train Shed beyond) ²⁴⁶



"While Grand Central was intricately woven into the city around it, Penn Station stood apart"

James Sanders, Urban Historian
Left: aerial view of the **Midtown Business District** with **Grand Central Terminal** at the heart of the **"42nd Street Corridor"** and the **"Grand Central District"**

247



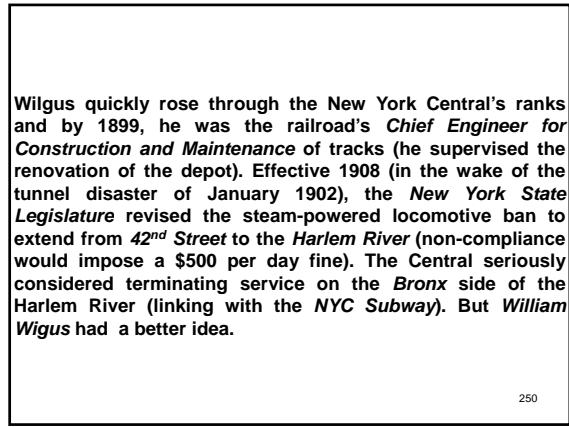
Wilgus

248



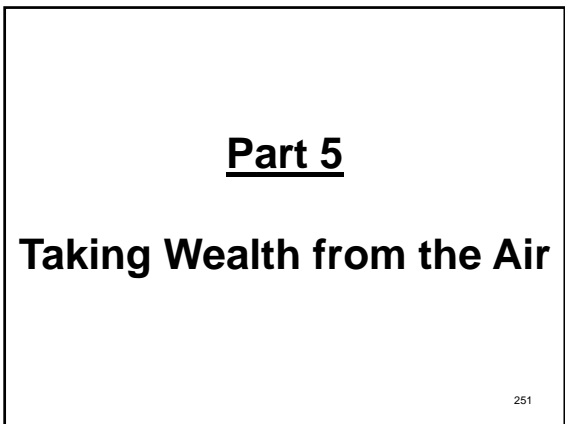
In 1893, **William John Wilgus** (1865-1949) began working for the **New York Central & Hudson River Railroad** as an assistant engineer on its **Rome, Watertown and Ogdensburg** line. A native of Buffalo, NY, Wilgus never formally attended a college of engineering. Rather, he apprenticed for two years under a civil engineer (he also took a correspondence course in drafting). With his visionary, creative mind Wilgus understood intuitively that the two main problems facing Grand Central were, insufficient capacity and steam locomotives.

249



Wilgus quickly rose through the New York Central's ranks and by 1899, he was the railroad's **Chief Engineer for Construction and Maintenance** of tracks (he supervised the renovation of the depot). Effective 1908 (in the wake of the tunnel disaster of January 1902), the **New York State Legislature** revised the steam-powered locomotive ban to extend from **42nd Street** to the **Harlem River** (non-compliance would impose a \$500 per day fine). The Central seriously considered terminating service on the **Bronx** side of the Harlem River (linking with the **NYC Subway**). But **William Wilgus** had a better idea.

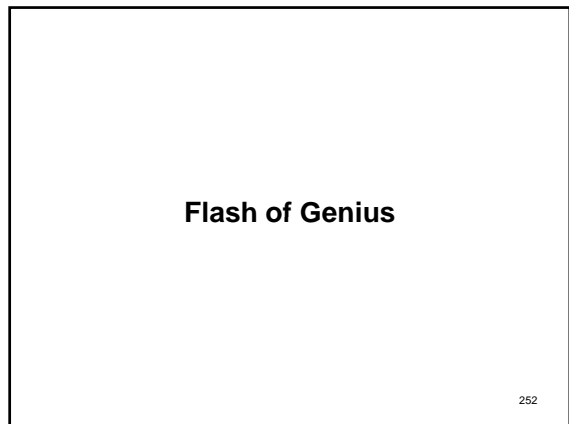
250



Part 5

Taking Wealth from the Air

251



Flash of Genius

252

“Suddenly, there came a flash of light. It was the most daring idea that ever occurred to me”

William J. Wigus

RE: after the January 1902 crash in the *Park Avenue Tunnel*, Wigus sent a letter later that year (on December 22nd 1902) to *W.H. Newman*, President of the *New York Central RR* outlining his ideas for utilizing underground electric trains and for a new terminal building. By January 10th 1903, the Central's Board of Directors; which included *J. P. Morgan*, *William Rockefeller* and the Commodore's grandsons: *Cornelius Vanderbilt II* and *William K. Vanderbilt*, accepted Wigus' plan and appointed him *Vice President in Charge of Construction*. Not only would electric trains eliminate the smoke in the tunnel/s problem, they were easier to maintain and did not require fuel on-board for power thus saving space and weight. Also, electric trains could accelerate more rapidly; ideal for commuter trains making frequent stops and starts. Subterranean tracks would be entirely feasible and open-ended train sheds would no longer be required. Most significant, a two level terminal (upper for long-distance, lower for suburban commuter trains) could/would replace the entire rail yard which extended to *56th Street* (where they converged into the four right-of-way tracks) and could be covered over and the "air rights" above (for fourteen blocks north) sold to real estate developers whose buildings would straddle the tracks below, thus paying back (with profit) the enormous cost (estimated to be \$35 million).

253

“Dear Sir: I take pleasure in sending to you herewith a portfolio of suggested preliminary plans for a proposed Grand Central Terminal to be constructed in conjunction with the depression of our yard...These suggested plans, in addition to offering attractive hotel, office, restaurant, store and railroad space...will probably make it the most attractive locality in New York City and gain for us the approval of the general public and the municipal authorities.”

William J. Wigus

RE: excerpt from correspondence to NYCRR president *W.H. Newman*, March 19th 1903

254

“...For decades it had owned the land where the tracks thrust their way down to the very heart of the island and there spread out to form the huge, gapping, dirty, unsightly train yards...the builders of the new terminal developed the idea of roofing over the tracks and the trains and building above them...This possibility, this idea, was fraught with tremendous importance to the City of New York. Its development meant reclamation work in the busiest and most compressed part of the continent...It meant the restoration to the city of streets that for years had been given over to the purposes of the railroad...”

The New York Times, February 2nd 1913

255

The Practicality of the Scheme

256

“At first, he properly questioned the practicality of the scheme. He felt that the office space would be a place only for birds to roost”; that the proposed hotel on the vacant square bounded by Madison Avenue, 43rd and 44th Streets and Vanderbilt Avenue, would be as unpopular as railroad hotels in Europe; that hansom cab-men could not be driven to use Madison Avenue because of their addiction to the sights of Fifth Avenue; and that underground horse cab-stands would be repulsive because of odors. My counter-arguments were that the rapidly increasing demand for office space in the vicinity would surely bring us tenants; that the use of electricity would obviate the features that made the European railroad hotels unpopular; that growing congestion would cause the cab-man to gladly avail himself of the new thoroughfares; and that the coming of the motor-car, then in its infancy, instead of the horse-drawn vehicle would obviate objectionable odors. It was also necessary to urge counter-arguments against the allegations of those who were not friendly to ramps in place of stairways and who opposed what they termed the 'grocery store' idea of lending the station to revenue producing purposes.”

William J. Wigus

RE: recalling in later years *New York Central* president *W.H. Newman's* response to his letter outlining his ideas

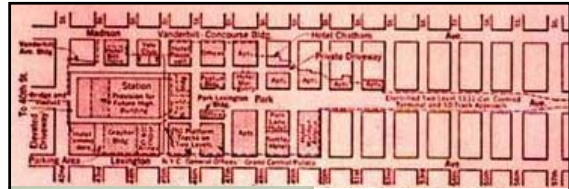
257

The Beginning of Midtown

258



"While house wreckers are tearing down the old Grand Central Station the New York Central's staff of engineers and draughtsmen are finishing the plans which will extend Park Avenue northward from the new station to Fifty-seventh Street over what is now a deep gully threaded with the tracks of the new terminal system."
 The New York Times, June 26th 1910
 259



Above: map (ca. 1917) of the development of Park Avenue above the underground train tunnels serving Grand Central Terminal marking the beginning of "Midtown" development
Left: view looking south on Park Avenue from 54th Street (ca. 1930s)
 260

"...The entire scheme involves the use of some thirty city blocks. Part of this the railroad already owned. Part of it had to be specially bought, but the idea of using the air rights reduced by an immense sum the cost of the terminal. From a business standpoint, it was just as though the space to be excavated for the tracks of the terminal were in a part of the country where land cost little or nothing instead of in one of the busiest and intense parts of Manhattan..."
 The New York Times, February 2nd 1913
 261



Above: subterranean double-level track lay-out (to the north of the new terminal) and the plan for Park Avenue and cross-streets
Left: track and block/lot plan (42nd to 52nd Street/s between Lexington and Madison Avenue/s)
 262

Terminal City

263

"...more than a gateway, more than a terminal. The terminal proper, the great head house, and its accompanying buildings, are simply the heart and the cause of a group of buildings that has been described as 'terminal city'..."
 The New York Times
 RE: when construction began in 1903 on the new terminal, the value of the land bounded by Lexington and Madison Avenue/s, from 41st to 57th Street/s, was valued at \$55 million. By 1914 – just one year after GCT opened, it was valued at \$117 million. By the mid-1920s, the value had more than doubled again. The NYCRR invested heavily in the properties having a \$121 million stake in twenty-one buildings by 1946.
 264

The Wonder in Their Midst

265

"Right in the centre of New York stands a group of connected buildings that are unique in the world's history. A man born in one of these buildings could live, carry on a large business and enjoy life's comforts and luxuries without ever emerging from beneath a roof...It consists of Grand Central Terminal and the buildings which can be reached from this massive central structure without setting foot outdoors. In this unit may be found every kind of food and clothing a human being needs, great banks, restaurants, stores of all descriptions and even picture galleries. It contains world-famous chefs, renowned orchestras, roof gardens and one of the largest ballrooms in the world. But all this has grown up so gradually before the eyes of New York's citizens that they have not realized the wonder that is in their midst."

The New York Times, August 29th 1926

266



"...The two levels of tracks reaching from the outskirts of the city to Forty-second Street have been depressed below the surface of the streets, great girders have been swung across to support the restored thoroughfares, and over all the buildings of the terminal city are rising one by one, a real estate development of monumental proportions..."

The New York Times, February 2nd 1913

267

"The term 'Grand Central' no longer designates a mere railroad station, but a large and impressive civic center...where there were formerly smoking tracks and four-story buildings, there are large handsome structures – office buildings, stores, hotels, apartments and clubs...In fact, the whole surrounding neighborhood now goes by the name of the Grand Central District, and is one of the chief business centers of the metropolis."

Engineering News-Record, September 9th 1920

268

One Stately Architectural Plan

269



"...Of the thirty blocks, some fourteen are already built on or definitely allotted. The remaining sixteen are yet to be allotted. The terminal itself, with the offices over the baggage quarters, the extra office building, the Grand Central Palace, with its auditorium, the power and heating plant, the Adams Express Building and the Post Office are completed. The Biltmore Hotel and the incoming station, another hotel, and a Y.M.C.A. are definitely decided upon. It is highly probable that the new home of the Yale Club and the Racquet Club will be placed within the terminal group..."

The New York Times, Feb. 2nd 1913

Left: Caption: "Birds-eye view of the new Grand Central Station as it will look when completed"

New York Tribune, June 26th 1910

270



Above: caption: "The 'Terminal City,' showing work when completed" (drawn by Vernon Howe Bailey)

271

Dreams that the Architects Dreamed

272

"...There are other building enterprises that have been spoken of, but which today are little more than dreams, dreams that the architects dreamed when they found themselves facing an opportunity so unusual in the history of city building. They found themselves working with big spaces in the heart of the metropolis. They realized that only within the area of the terminal city could a space of 400 feet by 400 feet of commercial ground easily be put to the use of some big artistic enterprise. Only in the jealously guarded parks of Manhattan could the National Academy of Design find another spot so suited to its purpose or the Directors of the Metropolitan Opera House find space at once so ample and so accessible for a new home. The possibility was immediately presented then, of having Park Avenue open into a great plaza with stately new opera house set in the centre, rivaling the beauty of the Plaza de l'Opera in Paris. The idea of placing the Metropolitan in the terminal group is an architect's dream. At present it is nothing more. So there has been talk of placing the National Academy there and other similar buildings, but they are dreams only. The future may see them there, and it may not..."

The New York Times, February 2nd 1913

273



"...Park Avenue, restored from Forty-fifth Street north as a great double thoroughfare, is another, and, for the buildings themselves, that in cornice lines and general style they will be made to conform to the one stately architectural plan. Harmony, then, is another element in the promised beauty of the terminal city..."

The New York Times, February 2nd 1913

274

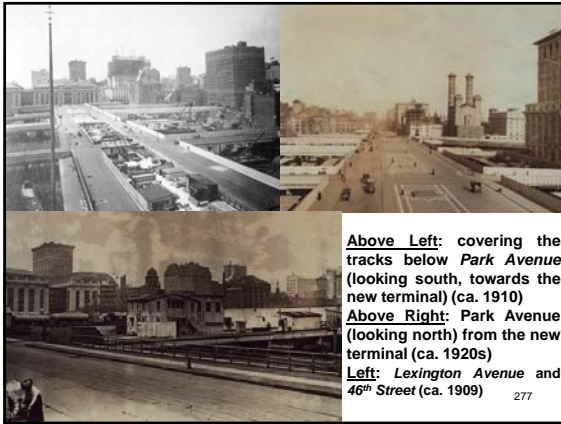
To Fashion Anew

"...The old Grand Central was considered the marvel of its day, but when it became outgrown and the Directors of the New York Central and the New York, New Haven and Hartford began to consider the ways and means for building its successor they undertook a task larger than the mere replacing of the old station by a newer and larger one. They undertook to fashion anew that entire section of the city where the old station stood, to build or cause to be built thirty blocks of buildings in Manhattan, all guided by one hand that would supervise their purposes and direct the general harmony of architecture..."

The New York Times, February 2nd 1913

275

276



Cinderella Story

278

"The story of Park Avenue is the old story of Cinderella. Yesterday a kitchen drudge of a street, today a resplendent princess; and the Fairy Godmother who waved the wand and wrought the change was electrification."
 Bartlet Maurice, Author

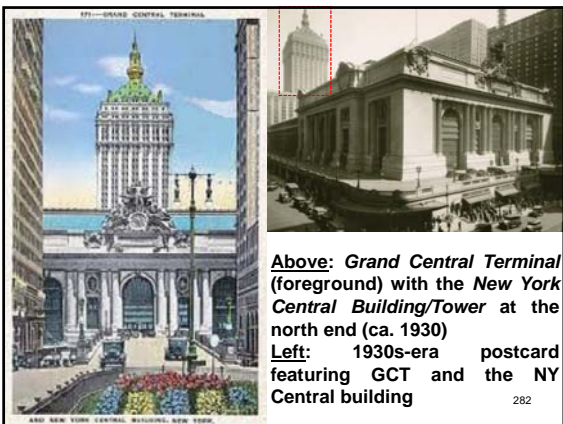
279

The Most Striking Thing

280

"...It is one of the most striking things about the terminal city that it will be an array of buildings without any real basements – without any basements that are really at the base of the buildings. In the buildings already completed, the Grand Central Palace, for instance, or the huge office building that accommodates the executive business of the road and the terminal, the 'basements' are on the fourth floor. They call these quarters 'basements' because they are dedicated to purposes usually fulfilled by basements. They have storage rooms, and they accommodate the big pipes from which radiate the myriad pipes to heat the rooms..."
 The New York Times, February 2nd 1913

281



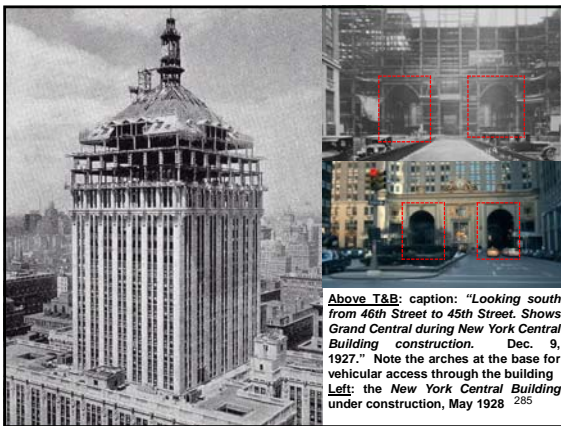
The Keystone

283

"...designed by Warren & Wetmore and completed in 1929, a perfect punctuation mark in the midst of Park Avenue's sobriety. The New York Central Building rose higher than the others, as befitted not only the railroad's headquarters but the building in the center of the avenue; it culminated in a great pyramidal roof topped by an elaborate cupola. At the tower's base were set two great arches, vehicular tunnels which completed the impressive system of access and bypass roadways to bring traffic around the terminal. The building provided the perfect focus for the southward view from upper Park Avenue; it pulled the eye down that long line of apartment houses, gave it a moment of joy as it reached the exuberant top, then sent it on its way again, moving down the avenue..."

Paul Goldberger, Architectural Critic

284



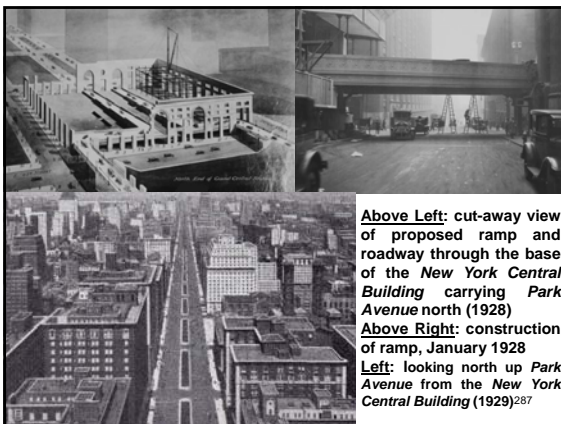
Above T&B: caption: "Looking south from 46th Street to 45th Street. Shows Grand Central construction. Dec. 9, 1927." Note the arches at the base for vehicular access through the building **Left:** the New York Central Building under construction, May 1928 285



"Traffic will pass directly through a skyscraper in a unique project now under construction in the very heart of New York City. One of the principal highways of the city, leading to a great railroad terminal, the Grand Central Station, is to pierce the thirty-two-story structure with twin tunnels. When the work is finished, you will be able to drive into the building at street level, climb through it on an inclined roadway, and emerge at the other side on an outdoor elevated roadway, that circles the station itself at a height of one story above the street."

Popular Science, April 1928

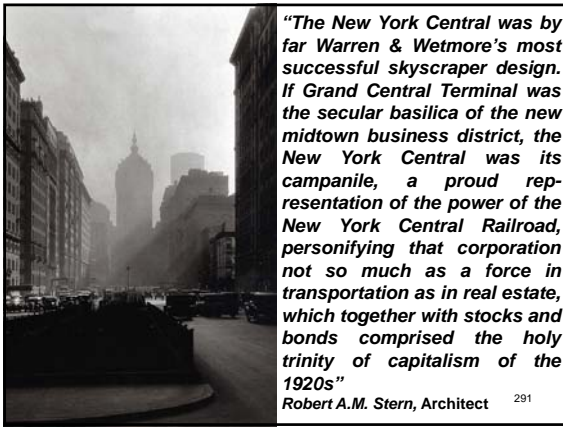
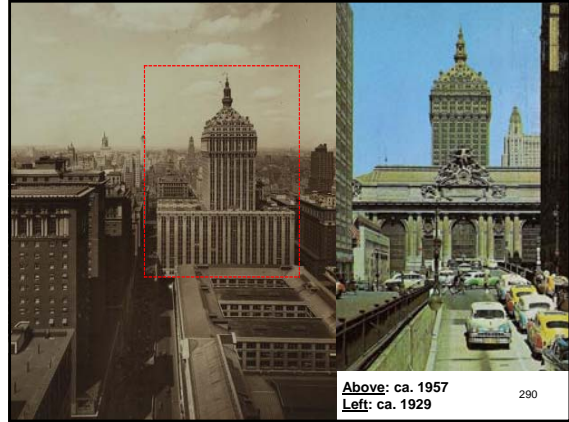
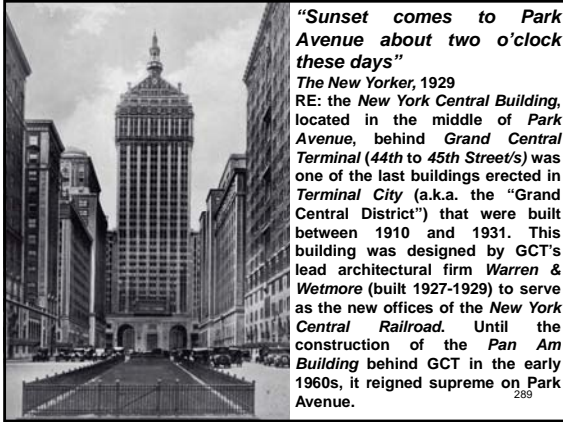
286



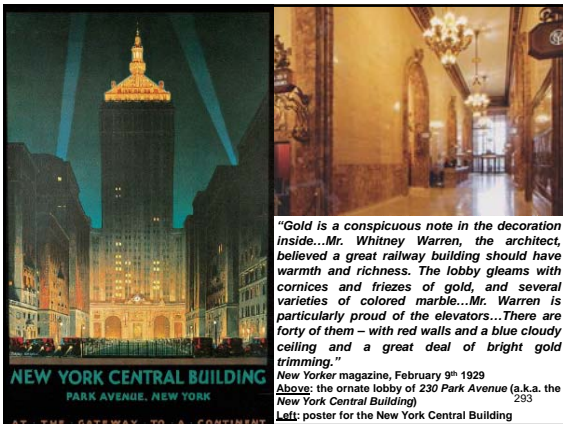
Above Left: cut-away view of proposed ramp and roadway through the base of the New York Central Building carrying Park Avenue north (1928) **Above Right:** construction of ramp, January 1928 **Left:** looking north up Park Avenue from the New York Central Building (1929) 287



288

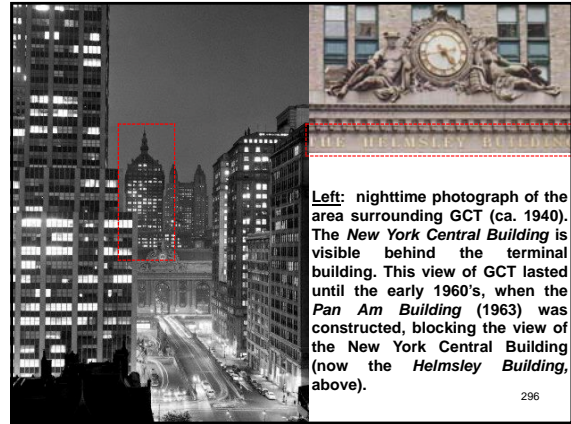


A Sense of Imperial Grandeur





"On the left is Transportation, symbolized by a male figure who bears a general resemblance to our old friend Mercury. His mate, a graceful woman, carries the attribute of industry, the distaff, while her arm, with a certain recklessness, embraces a beehive. The design is instinct with the elegance of style for which McCarten is famous: a style derived from the French, and consequently admirably suited to the spirit of the detail with which Warren & Wetmore have enriched these high portals."
 New Yorker magazine, Decemeber 15th 1928
 RE: the clock and figures over the 46th Street entrance to the New York Central Building (above). It was designed by Edward McCarten who was clearly influenced by the monumental sculpture for GCT's facade. 295

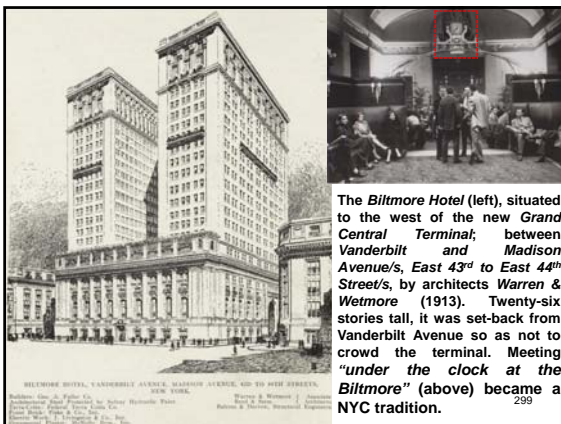


Left: nighttime photograph of the area surrounding GCT (ca. 1940). The New York Central Building is visible behind the terminal building. This view of GCT lasted until the early 1960's, when the Pan Am Building (1963) was constructed, blocking the view of the New York Central Building (now the Helmsley Building, above). 296

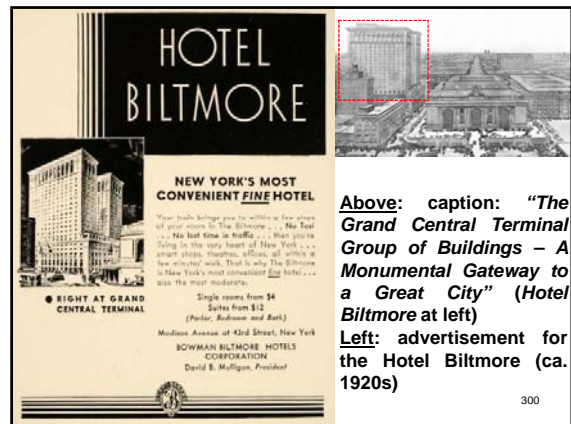
Far More than a Dream

297

"...But the Biltmore Hotel is far more than a dream. It is a definitely planned hotel that will tower twenty-three stories into the air, just to the west of the terminal. In some ways the Biltmore will be just a little different from any other in the long list of New York hostleries. It will owe its distinction to being part and parcel of the terminal itself, for the Biltmore is to rise above the incoming station. The passenger arriving at the terminal from somewhere beyond the limits of New York will be able to walk directly to the elevators that will lift him to the lobby of the Biltmore. He will be able to go directly from his seat in the Pullman to his room in the hotel, not only without once having passed beyond what will really be one structure..."
 The New York Times, February 2nd 1913 298



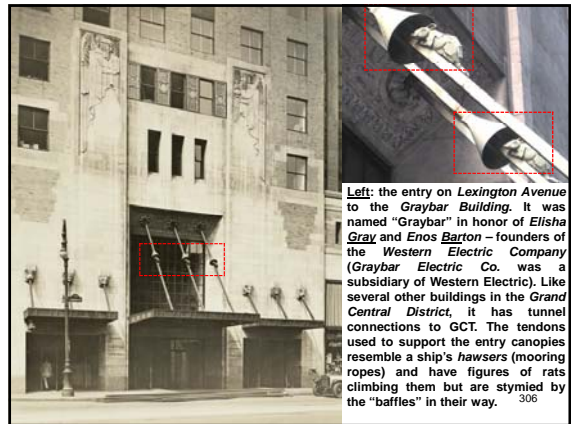
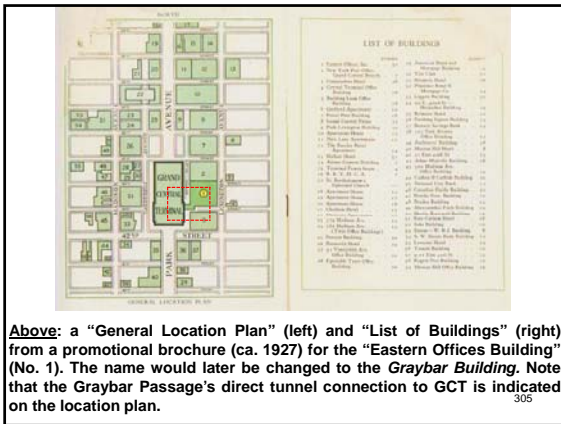
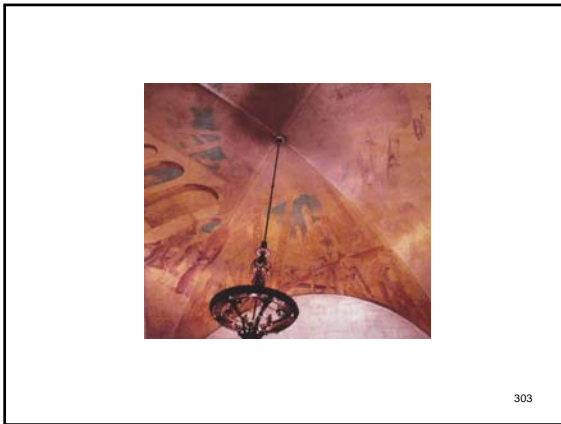
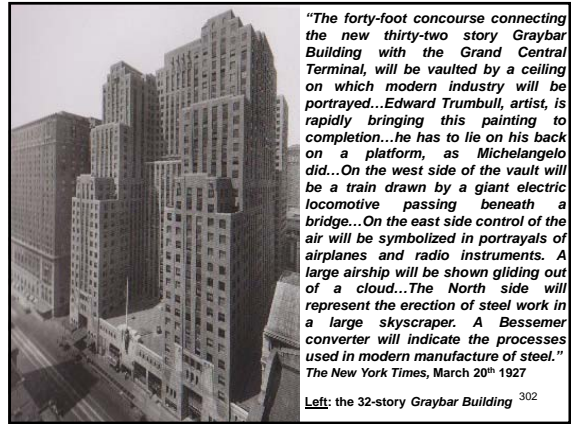
The Biltmore Hotel (left), situated to the west of the new Grand Central Terminal, between Vanderbilt and Madison Avenue/s, East 43rd to East 44th Street/s, by architects Warren & Wetmore (1913). Twenty-six stories tall, it was set-back from Vanderbilt Avenue so as not to crowd the terminal. Meeting "under the clock at the Biltmore" (above) became a NYC tradition. 299



Above: caption: "The Grand Central Terminal Group of Buildings - A Monumental Gateway to a Great City" (Hotel Biltmore at left)
 Left: advertisement for the Hotel Biltmore (ca. 1920s) 300

Graybar

301



Great Trains Pass Under Me

307

"He would have liked it better if the building had been anchored on solid rock. So now, as he felt the slight tremor in the walls once more, he paused, frowned and waited till it stopped. Then he smiled. 'Great trains pass under me,' he thought..."

RE: excerpt from *You Can't Go Home Again* by Thomas Wolfe

308

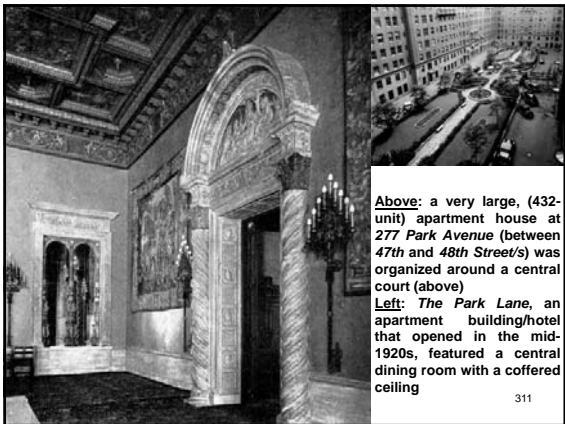
Homer G. Balcom, a prominent structural engineer for the twenty-story *Park-Lexington Building* (he's most remembered as the structural engineer for the *Empire State Building*) is credited with having devised a method of isolating support columns from the vibrations generated by trains via the track floor. In 1905, Balcom joined *Reed & Stem*. While overseeing the design of the new GCT and many interrelated structures, Balcom developed several innovative framing systems to span railroad lines, deal with track vibration and handle unstable foundation conditions. Included among his methods for insulating building frameworks from vibrations and stresses caused by track and street movements were effective uses of independent foundations, vibration-absorbing footing mats and vertical separations between buildings and traffic-carrying structures. A visible two-inch slot containing a vibration barrier separates many buildings on both *Park* and/or *Vanderbilt Avenue/s* from the sidewalk. The beams and girders that support the track levels and "roof" above (*Park Avenue*) are isolated from the columns that support the surrounding buildings of the *Grand Central Zone* to cut-off transmission of vibrations from the trains. Layers of lead, asbestos, sheet iron and other "baffling" materials were placed at the base of the 1,500 support columns for the track levels and streets above. As well, the columns were set deeper into the Manhattan bedrock to further dampen the vibrations. Even with these measures taken, the vibrations were not entirely eliminated. Just two protruding bolts in direct contact with a girder (supporting the tracks and street) caused noticeable vibrations throughout a luxury Park Avenue building. In general though, the vibration isolation seam around the buildings worked well in isolating the buildings from excessive vibrations.

309

"Everybody knows about the difficulty of building buildings over the Grand Central's tracks – how one apartment house vibrated distressingly for years until it was discovered that one little rivet in a pillar in the basement came in contact with metal connected with the tracks; and everybody knows how all the buildings in that region now are built with a two-inch space between the base of their walls and the sidewalks, because the sidewalks are supported by steel pillars springing from the track area and might transmit shivers all through the structures."

New Yorker magazine, February 9th 1929

310



Above: a very large, (432-unit) apartment house at 277 Park Avenue (between 47th and 48th Street/s) was organized around a central court (above)

Left: *The Park Lane*, an apartment building/hotel that opened in the mid-1920s, featured a central dining room with a coffered ceiling

311

Pershing Square

312



The area occupied by the *Park Avenue Viaduct* (outlined) became known as *Pershing Square*. Pershing Square hotels included, from left to right; the *Murray Hill Hotel*, the *Belmont Hotel*, the *Blitmore Hotel* and the *Commodore Hotel* (to the right of GCT). One more hotel was initially built around and connected to the new GCT: *The Roosevelt Hotel*, north of Pershing Square at *45 East 45th Street*. Designed by architect *George B. Post*, the Roosevelt opened on September 22nd 1924.

313

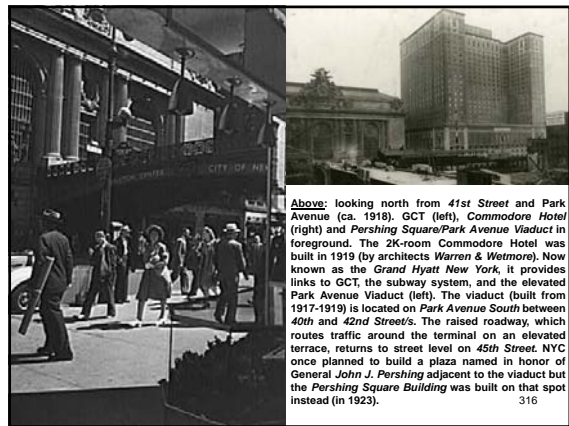
A Thoroughly Modern Hotel

314

"...A hotel of another type, a thoroughly modern commercial hotel with rooms numbering possibly up to 2,000 and any of them to be had on moderate terms, is planned for another part of the terminal group. It is probable that this will be built directly to the east of the head house at Forty-second Street and Lexington Avenue, where the hospital stands now. The only reason why the plans are not more definite is because the subway plans have not been more definite. When it is finally established just where the line of the Lexington Avenue Subway is to be, then the work of building the big commercial hotel will be started..."

The New York Times, February 2nd 1913

315



Above: looking north from 41st Street and Park Avenue (ca. 1918). GCT (left), Commodore Hotel (right) and Pershing Square/Park Avenue Viaduct in foreground. The 2K-room Commodore Hotel was built in 1919 (by architects Warren & Wetmore). Now known as the *Grand Hyatt New York*, it provides links to GCT, the subway system, and the elevated Park Avenue Viaduct (left). The viaduct (built from 1917-1919) is located on Park Avenue South between 40th and 42nd Street/s. The raised roadway, which routes traffic around the terminal on an elevated terrace, returns to street level on 45th Street. NYC once planned to build a plaza named in honor of General *John J. Pershing* adjacent to the viaduct but the *Pershing Square Building* was built on that spot instead (in 1923).

316



Pershing Square Building under construction (ca. 1922)

317



Caption (lower left): "*Pershing Square Building, Park Ave 41 to 42 Street, Made Feb 16, 1923, Charles T. Wills Inc., Builders N. Y. City. Irving Underhill. Pershing Square Building; Built: 1923; Architects: York & Sawyer. Built on the site of the Grand Union Hotel. The U-shaped 24-story building contained a basement restaurant, street level shopping, and a second floor banking room.*"

318

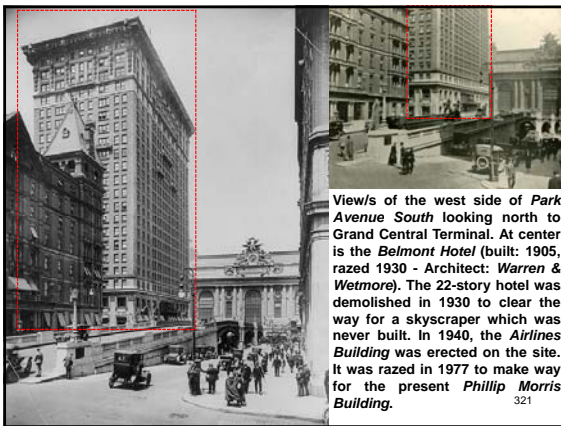
Enter The Donald

319



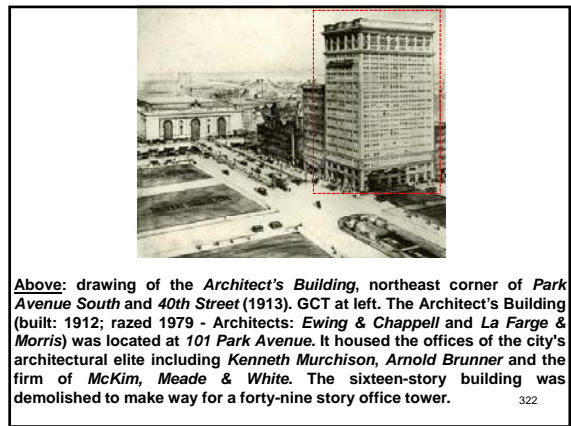
In 1974, a relatively young and very ambitious **Donald Trump** bought the **Commodore Hotel** for \$10 million. He worked out a deal to transform it into one of the first **Grand Hyatt** hotels. Trump negotiated various tax breaks and in the process agreed to renovate the exterior of GCT. The exterior masonry of the Commodore was covered with a mirror-glass curtain-wall facade. As part of the same deal, Trump optioned **Penn Central's** rail yards on the **Hudson River**, between **59th** and **72nd Street's** that would eventually become **Trump Place**. The Grand Hyatt opened in 1980 and the neighborhood immediately began a transformation. Trump later sold his interest in the hotel for \$142 million. The Commodore/Grand Hyatt deal established "The Donald" as a major player in New York City's real estate heirarchy.

320



Views of the west side of **Park Avenue South** looking north to Grand Central Terminal. At center is the **Belmont Hotel** (built: 1905, razed 1930 - Architect: **Warren & Wetmore**). The 22-story hotel was demolished in 1930 to clear the way for a skyscraper which was never built. In 1940, the **Airlines Building** was erected on the site. It was razed in 1977 to make way for the present **Phillip Morris Building**.

321



Above: drawing of the **Architect's Building**, northeast corner of **Park Avenue South** and **40th Street** (1913). GCT at left. The **Architect's Building** (built: 1912; razed 1979 - Architects: **Ewing & Chappell** and **La Farge & Morris**) was located at **101 Park Avenue**. It housed the offices of the city's architectural elite including **Kenneth Murchison**, **Arnold Brunner** and the firm of **McKim, Meade & White**. The sixteen-story building was demolished to make way for a forty-nine story office tower.

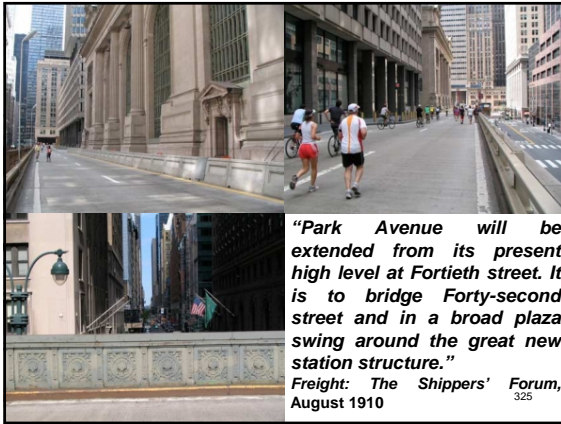
322



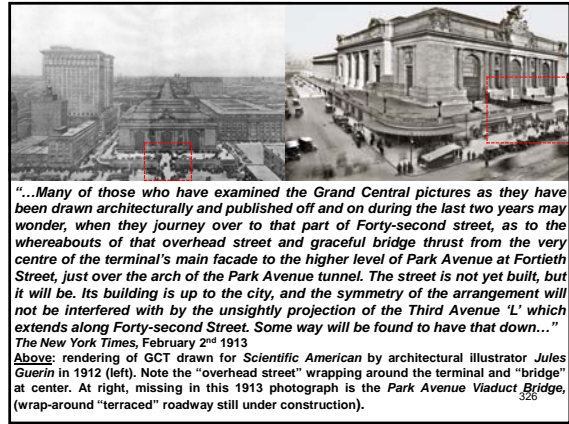
323

The Overhead Street

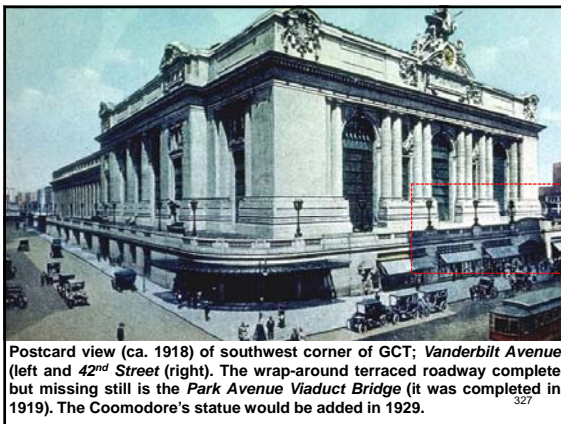
324



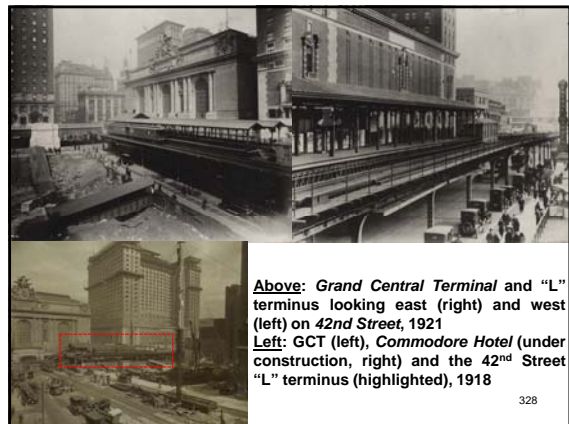
"Park Avenue will be extended from its present high level at Fortieth street. It is to bridge Forty-second street and in a broad plaza swing around the great new station structure."
Freight: The Shippers' Forum,
 August 1910



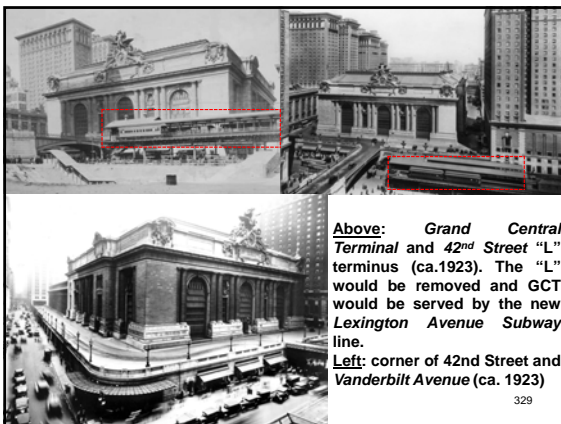
"...Many of those who have examined the Grand Central pictures as they have been drawn architecturally and published off and on during the last two years may wonder, when they journey over to that part of Forty-second street, as to the whereabouts of that overhead street and graceful bridge thrust from the very centre of the terminal's main facade to the higher level of Park Avenue at Fortieth Street, just over the arch of the Park Avenue tunnel. The street is not yet built, but it will be. Its building is up to the city, and the symmetry of the arrangement will not be interfered with by the unsightly projection of the Third Avenue 'L' which extends along Forty-second Street. Some way will be found to have that down..."
The New York Times, February 2nd 1913
Above: rendering of GCT drawn for *Scientific American* by architectural illustrator *Jules Guerin* in 1912 (left). Note the "overhead street" wrapping around the terminal and "bridge" at center. At right, missing in this 1913 photograph is the *Park Avenue Viaduct Bridge*, (wrap-around "terraced" roadway still under construction).



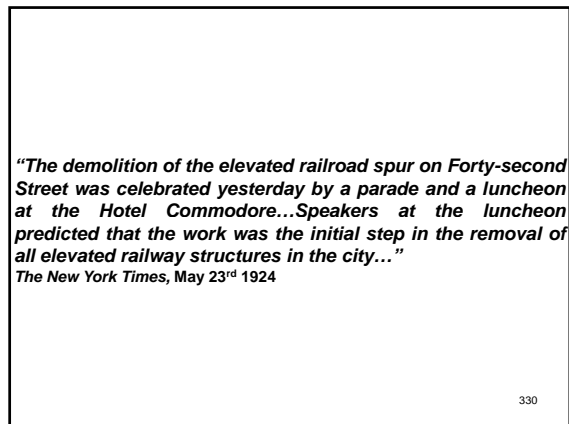
Postcard view (ca. 1918) of southwest corner of GCT; Vanderbilt Avenue (left and 42nd Street (right)). The wrap-around terraced roadway complete but missing still is the *Park Avenue Viaduct Bridge* (it was completed in 1919). The *Coomodore's* statue would be added in 1929.



Above: Grand Central Terminal and "L" terminus looking east (right) and west (left) on 42nd Street, 1921
Left: GCT (left), *Commodore Hotel* (under construction, right) and the 42nd Street "L" terminus (highlighted), 1918



Above: Grand Central Terminal and 42nd Street "L" terminus (ca.1923). The "L" would be removed and GCT would be served by the new *Lexington Avenue Subway* line.
Left: corner of 42nd Street and *Vanderbilt Avenue* (ca. 1923)



"The demolition of the elevated railroad spur on Forty-second Street was celebrated yesterday by a parade and a luncheon at the Hotel Commodore...Speakers at the luncheon predicted that the work was the initial step in the removal of all elevated railway structures in the city..."
The New York Times, May 23rd 1924

"...One of the unique features of the building, that means a great deal to the city of New York, because it opens up a north and south thoroughfare, is the overhead street. This approaches the building centrally at Forty-second Street, being carried over this as a viaduct. It then winds around either side of the Grand Central building as a broad terraced roadway raised above the main street level. It is by this street that Park Avenue passes around the station and continues north from Forty-fifth Street. The establishment of this new avenue will tend greatly to relieve the congestion on Fifth Avenue. From the overhead street there will be a cab entrance to the east-side of the station, enabling vehicles coming up Park Avenue from south of Forty-second Street to drive directly into the station, and after discharging their passengers leave the station on the Vanderbilt Avenue side..."

Scientific American Supplement, December 7th 1912

331



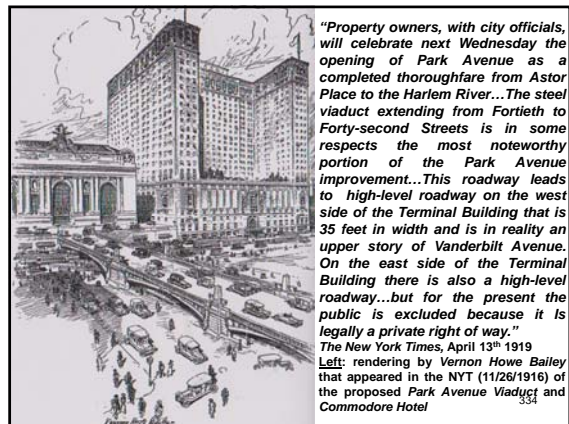
Above: overhead view of main facade (at right), terraced roadway below, 42nd Street and the viaduct bridge (ca. 1941)

Left: view of 42nd Street (looking west). GCT at right, with view of the terraced roadway along the main facade

332

Park Avenue Viaduct

333



"Property owners, with city officials, will celebrate next Wednesday the opening of Park Avenue as a completed thoroughfare from Astor Place to the Harlem River...The steel viaduct extending from Fortieth to Forty-second Streets is in some respects the most noteworthy portion of the Park Avenue improvement...This roadway leads to high-level roadway on the west side of the Terminal Building that is 35 feet in width and is in reality an upper story of Vanderbilt Avenue. On the east side of the Terminal Building there is also a high-level roadway...but for the present the public is excluded because it is legally a private right of way."

*The New York Times, April 13th 1919
Left: rendering by Vernon Howe Bailey that appeared in the NYT (11/26/1916) of the proposed Park Avenue Viaduct and Commodore Hotel*

334



"Traffic will be carried over Forty-second Street at this level by a bridge, which will be an exact copy of the famous Alexander III Bridge over the river Seine in Paris. This structure, which was erected several years ago in honor of Alexander III of Russia, is said to be one of the most beautiful in the world."

*New York Times, March 4th 1910
Above: the Alexander III Bridge*

335



The Park Avenue Viaduct (a.k.a. "Pershing Square Viaduct") runs from 40th Street to GCT. The Viaduct was conceived in 1903 by the architectural firm of Reed & Stem as an expeditious way of moving traffic along Park Avenue and around the massive terminal. As designed by architects Warren & Wetmore in 1912 (constructed from 1917-1919), it consists of three low, broad arches (all originally open) composed of steel girders cantilevered from granite piers with an ornate iron railing running along the roadway above the arches. The Park Avenue Viaduct was designated a landmark by the City of New York in 1980.

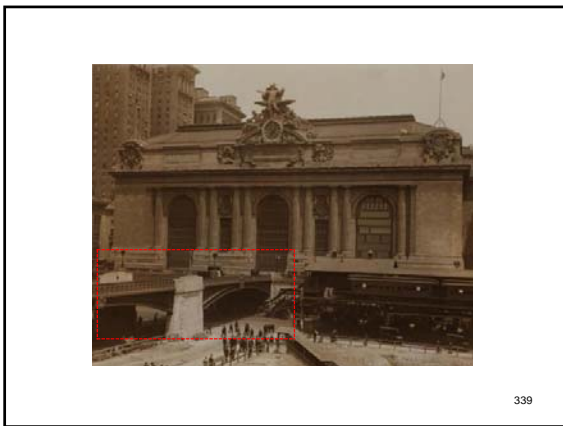
336



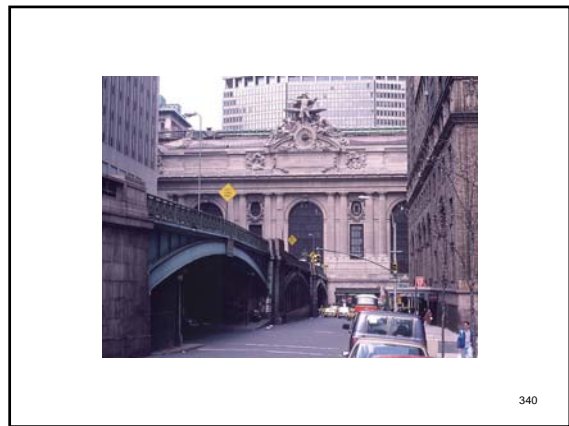
Left: Park Avenue Viaduct under construction in foreground (ca. 1918). Warren & Wetmore originally conceived the viaduct to have tall pylons; like that of the Alexander III Bridge (1900), but they were not realized.
Right: each arch measures 200-feet in length for an overall length of 600-feet. The center arch (outlined) was enclosed at street level and presently houses a retail establishment (restaurant). 337



Above Top: Park Avenue Viaduct (ca. 1925)
Above Bottom: viaduct bridge traffic and the Commodore's statue (ca. 1967)
Left: central (enclosed) arch 338



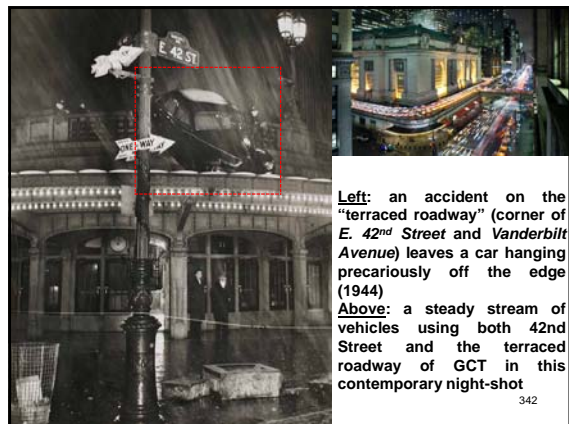
339



340

"...Once in place, this overhead street will be admirable for it is designed to do a large part in alleviating the street congestion and confusion at the doors of the terminal. The bridge will form the direct route for the approach to the station by carriages and automobiles. At its north end it gives on a gallery-like roadway that completely surrounds the head house and reaches each of the many carriage entrances, as well as the cab stands and baggage rooms just beyond. Besides lifting the vehicular burden from Forty-second Street this bridge furnishes the southern approach to that sumptuous boulevard which is being elaborated on the other side of the terminal and from there stretches due north as the main artery of the 'terminal city'..."
 The New York Times, February 2nd 1913

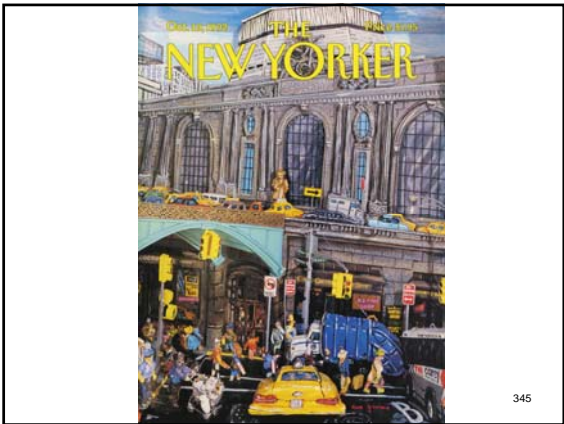
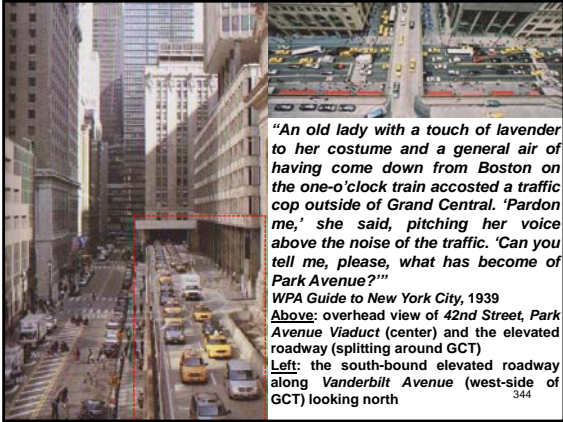
341



Left: an accident on the "terraced roadway" (corner of E. 42nd Street and Vanderbilt Avenue) leaves a car hanging precariously off the edge (1944)
Above: a steady stream of vehicles using both 42nd Street and the terraced roadway of GCT in this contemporary night-shot 342

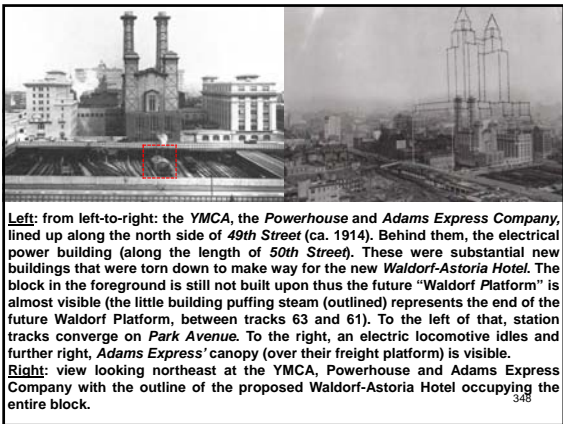
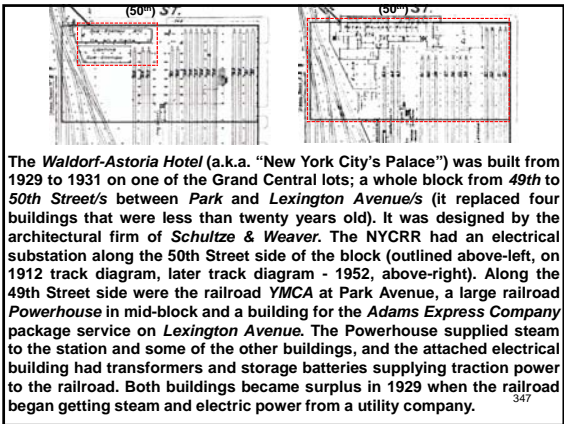
What Has Become of Park Avenue?

343



The Palace

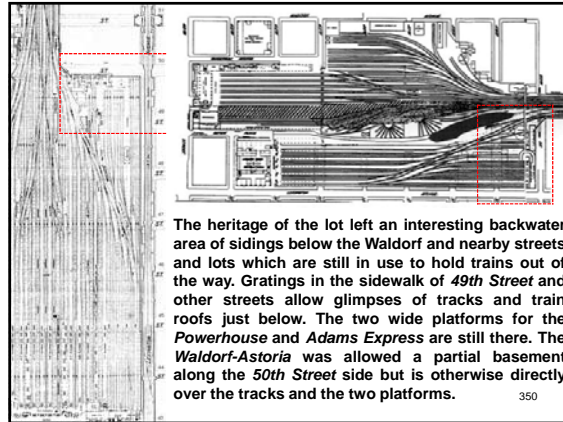
346



“Work in preparing the block bounded by Park and Lexington Avenues, Forty-ninth and Fiftieth Streets, for the new Waldorf Hotel will begin tomorrow with the demolition of the New York Central’s great electric and steam plants in that block which supply power, light, steam heat and hot water for the group of apartment houses, hotels and office buildings between Fiftieth Street and the Grand Central Terminal, as well as for railroad purposes. The plant, which contains the electrical converters through which passes the current providing power and light for trains and buildings, will be torn down and its mechanical facilities shifted a quarter mile south to the Grand Central Terminal.”

The New York Times, March 31st 1929

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350

The Result of the Operation

351

“The facilities removed have been placed so deeply underground that they will never be a nuisance or interfere with the full development of the terminal. They operate in their new surroundings as efficiently and as reliably as in their former locations...The result of the operation is to remove from the Fiftieth Street block a collection of buildings out of harmony with the splendor of Grand Central Terminal and to permit the erection on their site of a monumental building of surpassing beauty.”

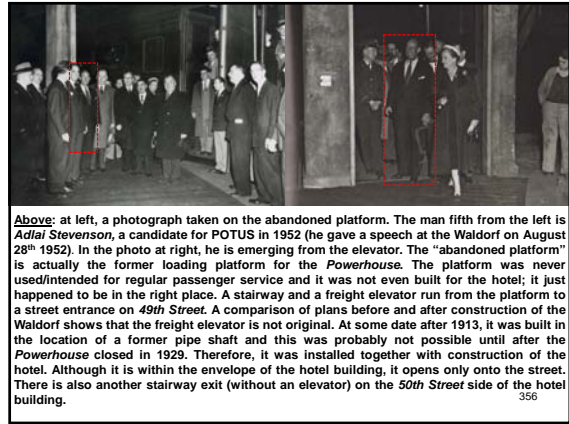
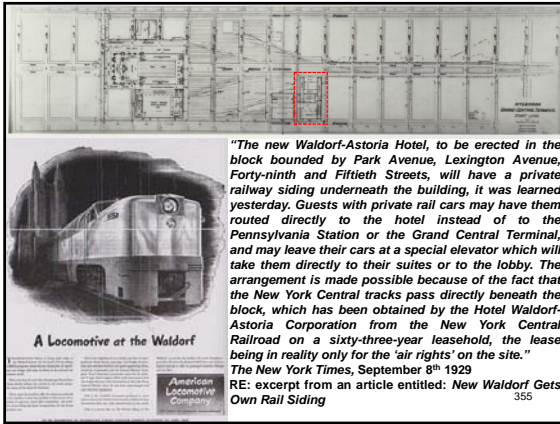
New York Central Lines Magazine, March 1930

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Track 61

354

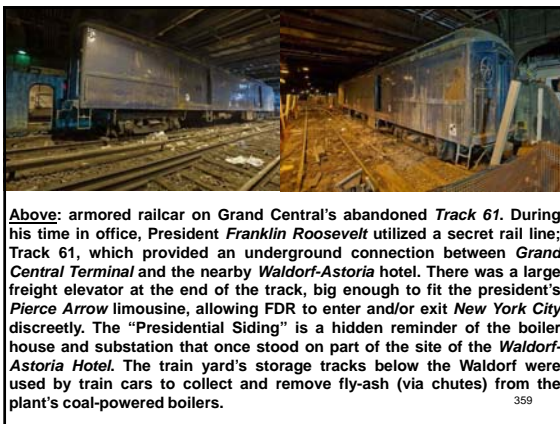


The Presidential Siding

357

"Its location above the tracks permitted the celebrated hostelry the unique distinction of its own railroad side track in the basement, so to speak. Officially identified as Track 61 in one of Grand Central's storage areas, with a freight elevator providing access to the hotel, the siding was used on occasion for the arrival or departure of distinguished guests traveling by private railroad cars. General John J. Pershing was the first to use it, on a visit to the city in 1938. During the 1944 campaign Franklin D. Roosevelt gave a foreign policy address at the Waldorf and then descended into the 'basement' to the presidential rail car for the journey home to Hyde Park. On other occasions the siding has been used for such diverse affairs as a 1947 'debut at the Waldorf' for a new 6,000 horsepower diesel locomotive, or for a 1965 'underground party' for pop artist Andy Warhol."
 William D Middleton, Author

358



"Metro North spokesman Dan Brucker said that President Roosevelt's 'armor-plated Pierce Arrow car would drive off the train, onto this platform and into the elevator, and it would bring him and his car into the hotel garage.' The 6-foot-wide elevator, built to accommodate a 6,000-pound armored car, is kept in shape by elevator mechanic Darick Jones. Once at street level, Jones yanks the elevator gates open to reveal 49th Street. Driving an automobile with a slim profile, one could still make a sharp, right U-turn into the Waldorf garage...The locked entrance to the secret station is down a stairway concealed behind a brass door marked 101-121 49th St, below a sign that reads 'Metro-North Fire Exit.'"
Journal-News, September 9th 2001
 RE: excerpt from an article entitled: *"Discovering the Secrets of Grand Central Terminal"*

360



Elevator door (center) at 101-121 East 49th Street (2002). The matching bay/s to the left go to the hotel garage and the closed one (on the right) probably once did too (it has protective curbs). The elevator, by contrast, not only has no curbs but has a small, well worn step. ³⁶¹



Top Left: view north (from 45th Street) looking up Park Avenue (ca. 1930s)
Top Right: view south (from 54th Street) looking down Park Avenue (ca. 1920s)
Left: the Waldorf-Astoria hotel and Park Avenue, looking south (ca. 1932). Including the Waldorf, only three pre-WWII Park Avenue North buildings remain. The others are Saint Bartholomew's Church, the Racquet Club and the Postum Building. ³⁶²

Saint Bart's

363

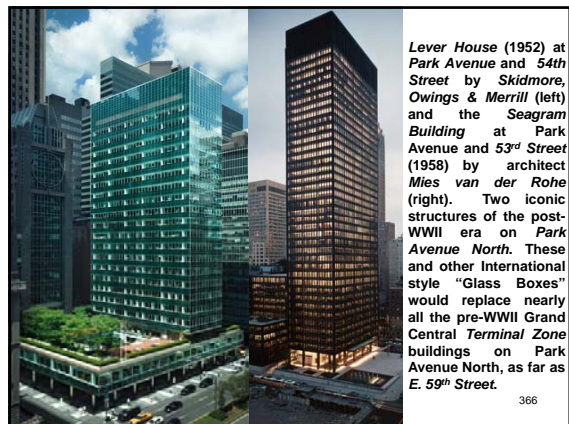


"...After completion of the New York Central's terminal work, which gave Park Avenue three new blocks from Forty-fifth to Fiftieth Street, the old brewery had stood as an obstacle...Today, the classic new edifice of St. Bartholomew's Church attests to the revolutionary change in the district." *The New York Times*, June 26th 1921

Above: at left, looking north up Park Avenue (around E. 49th Street), Saint Bartholomew's Episcopal Church is center-right in the photo (outlined). The photo was taken in 1922, prior to the widening of Park Avenue (1927). At right, looking across Park Avenue (to the SE corner of Park Avenue and E. 50th Street) at St. Bart's (the Waldorf-Astoria Hotel is in view to its right). The Byzantine-style church was designed by architect Bertram Goodhue and replaced the Schaefer Brewery formerly located on the site. The church was consecrated in 1918. ³⁶⁴

Glass Box Chic

365



Lever House (1952) at Park Avenue and 54th Street by Skidmore, Owings & Merrill (left) and the **Seagram Building** at Park Avenue and 53rd Street (1958) by architect Mies van der Rohe (right). Two iconic structures of the post-WWII era on Park Avenue North. These and other International style "Glass Boxes" would replace nearly all the pre-WWII Grand Central Terminal Zone buildings on Park Avenue North, as far as E. 59th Street. ³⁶⁶

Thus from the Air Would be Taken Wealth

367

"Thus from the air would be taken wealth with which to finance obligatory vast changes otherwise non-productive...could be transformed from a nonproductive agency of transportation to a self-contained producer of revenue – a gold mine so to speak"

William J. Wigus

RE: Wigus did not invent the concept of *air rights*, but he would exploit it on an unheard of scale to finance the electrification of the Central and to raze the old station and put in its place a state-of-the-art terminal. Despite the fact the NYCRR made most of its money hauling freight, not people, and the projected cost for the electrification/improvements represented approximately half the Central's annual income, the project was given the green light. No longer would passengers be transported downtown from Grand Central. Thus, the new edifice would be a *Terminal* rather than a *Station*.

368

Public Good, Private Gain

369

"...marked the opening of a remarkable opportunity for the accomplishment of a public good with considerations of private gain in behalf of the corporation involved"

William J. Wigus

370



"Park Avenue development within the last six years constitutes one of the most striking chapters in the real estate history of New York. The transformation of this broad highway, resting on the tracks of the New York Central railroad, from a lane of old flats and tumble-down nondescript buildings of various types within the last decade, into a leading residential community ranking with Fifth Avenue, records one of the most remarkable architectural triumphs in the annals of the city..."

The New York Times, June 26th 1921

Above: The Terminal Zone – from a promotional brochure for the New York Central Building (ca. 1928)

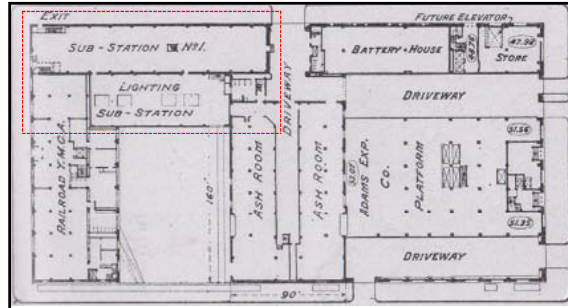
371

The Powerhouse

372



"...For all the buildings of the Grand Central group will be heated from one power and heating plant, the one already erected at Fiftieth Street, between Park and Lexington Avenues. Having no basements of their own, the buildings of the group, both present and prospective, will have to depend on the machinery housed at Fiftieth Street. This already sends the hot water down to the head house, to the general office, the Post Office, and so on, and some of it travels more than a mile before it returns to the heating plant at Fiftieth Street. From the roof of that plant two huge smokestacks rise to a towering height. These smokestacks are interesting, for they are the only ones in the whole thirty blocks. And when the thirty blocks have all been 'improved' they will remain the solitary smokestacks in that part of New York. Even they are equipped with the last word in smoke consumers, so that, even when it is a completed and thriving area, the terminal city will be smokeless. That is one element in the promised beauty..."
 373
 The New York Times, February 2nd 1913



Above: plan of the boiler house and substation (ca. 1912). E. 50th Street is at top and E. 49th Street is at the bottom of the plan. The NYCRR generated its own electricity at two power plants, one in Yonkers (Westchester) and the other in Port Morris (Bronx). Combined, they generated 11k-volt, 25-cycle AC which fed the sub-station located just east of Park Avenue. The substation converted the AC feed into 660-volt DC to power the Central's electric locomotives.
 374



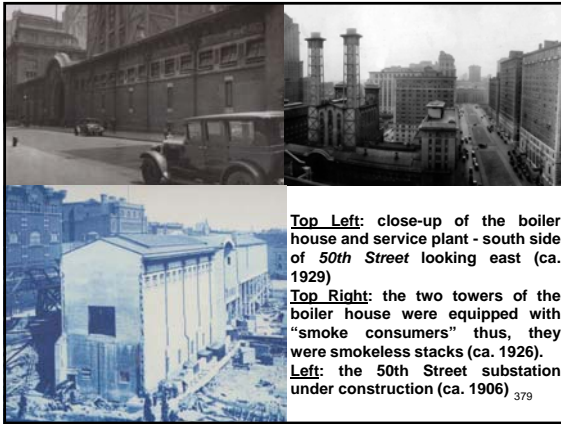
"The service plant furnishes electricity for lighting, the operation of elevator and other motors, heat for all buildings within the terminal. And steam for heating of cars in the station. Fire and service pumps, freight-elevator pumps, compressors and miscellaneous pumps and boiler-plant auxiliaries are also installed. The service station is primarily a heating plant. Steam required for heating cars within the terminal is drawn from the boilers through reducing valves...The heating of all the various buildings within the terminal area is by hot water, heated by the exhaust steam of the various units in the power plant...The water is heated in three large 'evenflow' exhaust-steam heaters, and is circulated by suitable motor-driven centrifugal pumps...Coal is delivered either by cars on the track level, or by trucks on the street level."
 Power magazine, May 20th 1913
 Left: view looking north of the NYCRR's boiler house and substation (ca. 1929) from Park Lane - a private street no longer in existence
 375

"The extent of the power and heating plant facilities serving the terminal layout is indicated by the fact that on the coldest days the coal consumption reaches 500 tons, and the average boiler load per day during a cold month is about 5,000,000 lbs. of steam...Both steam and hot water heating systems are used and the hot water mains alone have a total length of over four miles...A complete refrigeration plant is also included in the power units...From the 50th Street plant hot water for heating purposes is driven a mile in its circuit to most of the buildings in the group including the main station building, the incoming station, the terminal offices, the Post Office, general office building, the Vanderbilt Concourse Offices, Grand Central Palace, the Yale Club, the Biltmore Hotel, the Express Building and the Y.M.C.A., the last being in the same block as the 50th Street power plant. Three stages of pressure are necessary to provide for the great height to which hot water is raised in connection with heating the Biltmore Hotel."
 376
 Engineering News-Record, September 9th 1920

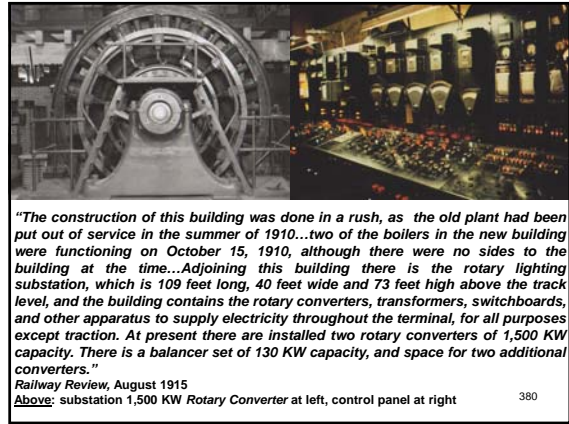


Right: early postcard, caption: "The Grand Central Terminal Showing Hotel Commodore, Yale Club and Biltmore Hotel. New York City." The Commodore Hotel is to the right of GCT, fronting on 42nd Street with Depew Place separating it from the terminal. The Yale Club and Biltmore Hotel are to the left of GCT, fronting on Vanderbilt Avenue, across from GCT.
 377

"The water mains are divided into three groups, carrying different pressures to conform to the height of the building. A building seven stories high is connected to the low pressure system; buildings above this height up to seventeen stories use the intermediate pressure system for the section above the part taken by the low-pressure system, while stories beyond seventeen, up to and including twenty-seven stories, are supplied by the high-pressure system. This hot-water heating system, with its provision for extension, is the largest of its kind existing, and will be ample to supply a town having between 6,000 and 7,000 standard country homes...The water circulated through these systems is not wasted, but is reheated and pumped continuously throughout the system, all of the exhaust steam available from the steam turbines and auxiliaries at the service plant being used for heating, supplemented by live steam when the heating loads exceed the amount of exhaust steam available."
 Railway Review, August 1915
 378



Top Left: close-up of the boiler house and service plant - south side of 50th Street looking east (ca. 1929)
Top Right: the two towers of the boiler house were equipped with "smoke consumers" thus, they were smokeless stacks (ca. 1926).
Left: the 50th Street substation under construction (ca. 1906) 379

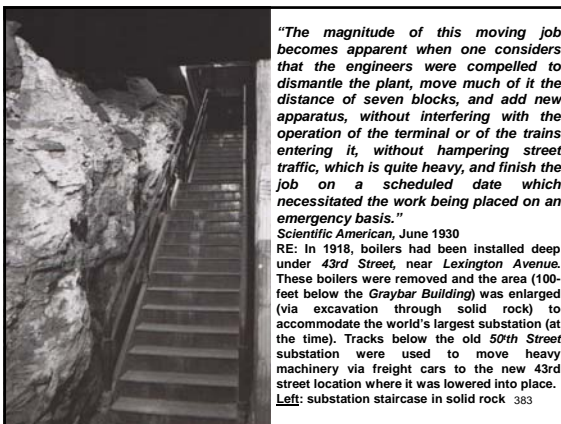


"The construction of this building was done in a rush, as the old plant had been put out of service in the summer of 1910...two of the boilers in the new building were functioning on October 15, 1910, although there were no sides to the building at the time...Adjoining this building there is the rotary lighting substation, which is 109 feet long, 40 feet wide and 73 feet high above the track level, and the building contains the rotary converters, transformers, switchboards, and other apparatus to supply electricity throughout the terminal, for all purposes except traction. At present there are installed two rotary converters of 1,500 KW capacity. There is a balancer set of 130 KW capacity, and space for two additional converters."
 Railway Review, August 1915
Above: substation 1,500 KW Rotary Converter at left, control panel at right 380

The Moving Job

381

"Among the wholesale business secured by The New York Edison Company is the group of 30 large buildings in the Grand Central Terminal area, formerly supplied by The New York Central and Hudson River Railroad Company, with installations aggregating about 30,000 kilowatts, and an annual consumption exceeding 50,000,000 kilowatt hours."
 Consolidated Gas Company of New York and its Affiliated Gas and Electric Companies, Annual Report, 1927
 RE: Consolidated Gas Company of New York - forerunner of the Consolidated Edison Company (a.k.a. "Con Ed") was supplying the Central with electrical power in bulk on a contract basis for GCT and the buildings of Terminal City by 1927. The 50th Street boiler house and substation continued operations until 1930 by which time the value of land in the vicinity of Park Avenue North made it and adjoining structures untenable thus the entire block would become the new home of the Waldorf-Astoria Hotel (the original Waldorf was located on the site now occupied by the Empire State Building). Without the boiler house, the Central would no longer be able to produce steam for its operations so it contracted with the New York Steam Company to supply its needs. However, the substation would be a different story altogether. 382

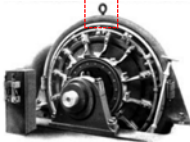


"The magnitude of this moving job becomes apparent when one considers that the engineers were compelled to dismantle the plant, move much of it the distance of seven blocks, and add new apparatus, without interfering with the operation of the terminal or of the trains entering it, without hampering street traffic, which is quite heavy, and finish the job on a scheduled date which necessitated the work being placed on an emergency basis."
 Scientific American, June 1930
 RE: In 1918, boilers had been installed deep under 43rd Street, near Lexington Avenue. These boilers were removed and the area (100-feet below the Graybar Building) was enlarged (via excavation through solid rock) to accommodate the world's largest substation (at the time). Tracks below the old 50th Street substation were used to move heavy machinery via freight cars to the new 43rd street location where it was lowered into place.
Left: substation staircase in solid rock 383

"It was necessary to transfer, among other material, an 8,000 ampere electric storage battery consisting of 150 tanks weighing 5,000 pounds each. In every tank were lead plates submerged in sulphuric acid. As it is against the law to transport such open tanks of acid through the city streets, the New York Central made use of tunnels that run through the terminal."
 Scientific American, June 1930 384

20/20 Foresight

385



"Years ago the engineers of the New York Central Lines foresaw the possibility that they would some day have to transfer the heating plant to Forty-third Street, and they kept free a large excavation in that section. Plans for this new structure were laid out even before the Graybar Building was constructed, and when the time came for demolishing the old power house at Fiftieth Street everything was in readiness...The new plant is cradled in the bedrock of the island. Great steel beams and pillars support the weight above. Thousands of feet of pipe and wire wind in and out. Heavy armatures, when they are being lowered by crane into the depths, vaguely resemble divers going to explore the sea bottom...The new substation will have a preliminary capacity of 25,000 kilowatts, with room for expansion up to 32,600."

The New York Times, December 1st 1929

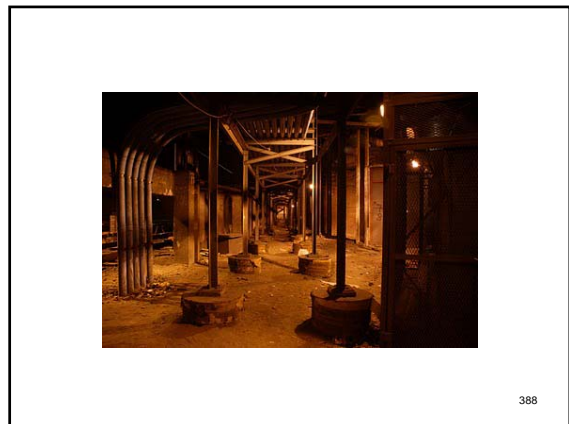
Above: 1,500 KW Rotary Converter (note the lifting ring welded at top)

386

The present site of the substation – an excavation about 90 feet deep and 225 feet long by 60 feet wide – had previously been made in the solid rock under 43rd Street, to accommodate a boiler plant. Two boilers were installed, with room for four more. This plant consisted of four floors: a basement, a boiler room, a meter room, and the coal bunkers. The stack extended to the top of the Commodore Hotel and was concealed in that structure. Another vast cellar was also dug out under the southern end of the Graybar Building...Calculations then established the fact that it would be possible to utilize the great stone vault, intended for the boiler plant, as the new site of the substation."

Scientific American, June 1930

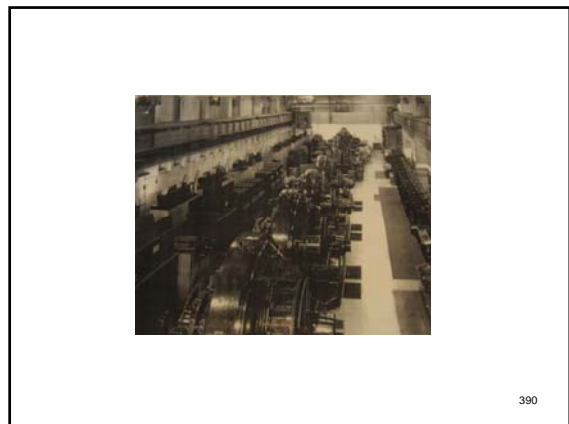
387

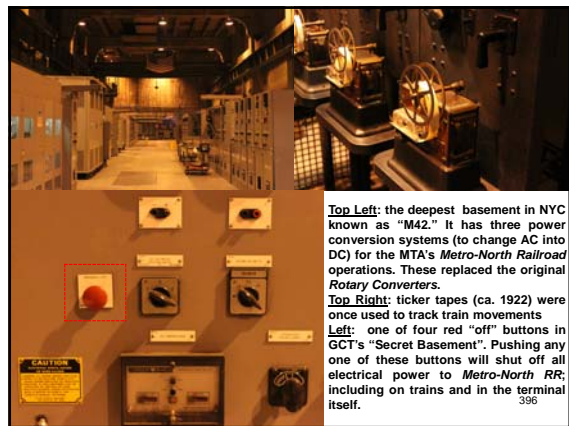
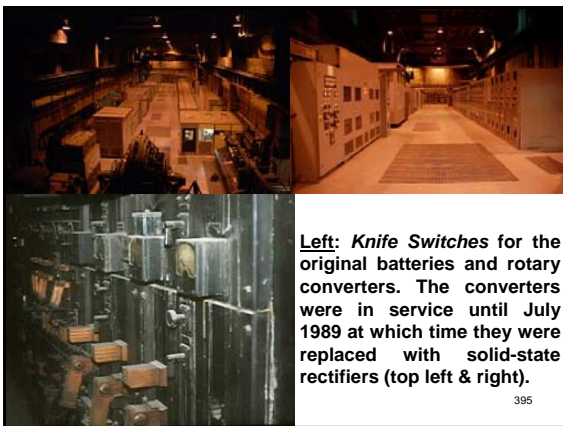
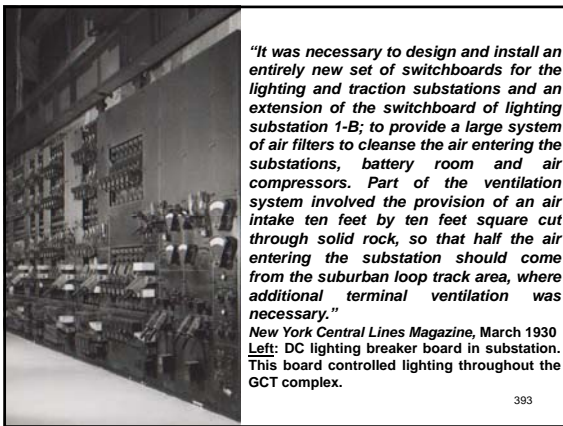
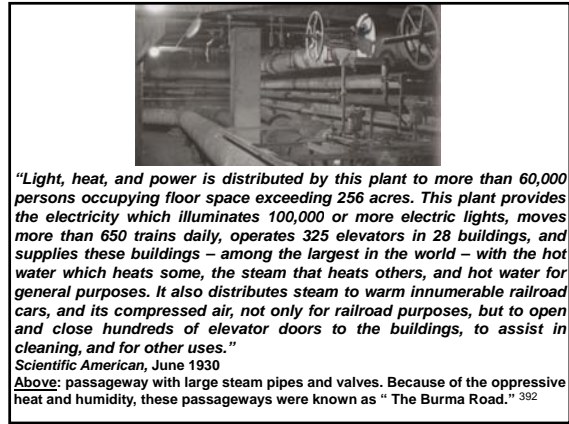
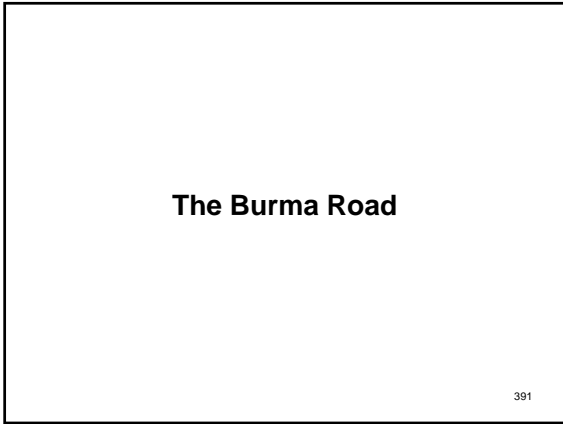


"The new plant contains only the most up-to-date equipment. Five large General Electric rotary transformers will convert traction power for trains, totaling 17,000 kilowatts. Five other converters will provide 8,000 kilowatts of electric current for lighting and for elevators. One electric and two traction rotaries are already in operation and the others will be put in service as soon as installed. Three of these rotaries, each with a capacity of 4,000 kilowatts, are brand new and represent the latest in size and force. The others are being brought from the former plant at Fiftieth Street...Air for cooling the apparatus will be drawn down into the subterranean depths through the ash hoist once used in conjunction with the former boiler plant."

The New York Times, December 1st 1929

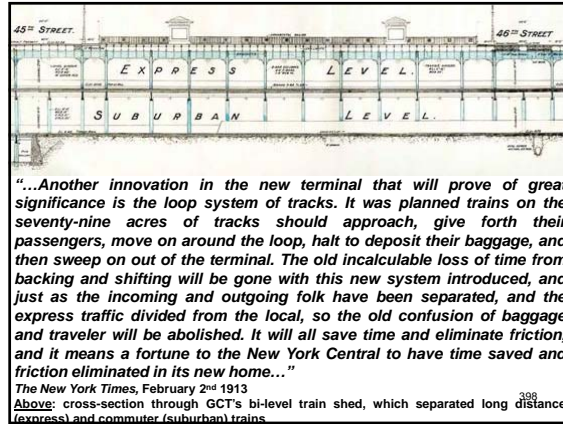
389





Divide and Conquer

397



When GCT opened for business on February 2nd 1913, its underground train shed had a capacity for 123 active tracks. Sixty-seven served trains on both the upper and lower levels carrying passengers and mail;

- Tracks 1 thru 42 on the upper level (long-distance trains)
- Tracks 101 thru 125 on the lower level (commuter trains)

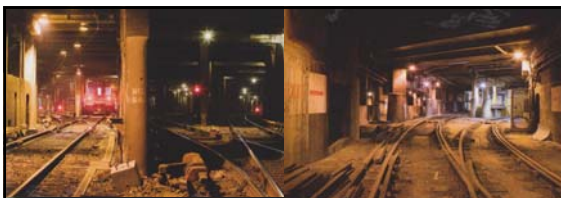
The balance of fifty-six tracks were used for cleaning, storage and maintenance. At both levels, tracks cutting diagonally across the train shed (known as “Ladder Tracks”) allowed for easy access to other tracks and special “Loop Tracks” allowed for quick turnarounds. Though it has varied over the years, on average the upper level used twenty-seven tracks for boarding trains, twenty-eight (shorter) tracks for express and mail services while the balance were used for storage during long-distance train assembly. Seventeen tracks were used on the lower level for passenger boarding while thirty-six plus were used for train storage and several other tracks were used for maintenance. The design of the lower level allowed all tracks to be used for either passenger boarding or equipment storage.

399

“Few of the millions who annually go through Grand Central Terminal see all of it because the building was designed to keep 30,000 people at a time moving to and from trains. The trains themselves, during rush hours, glide in or out at the rate of one every minute on its 67 stub tracks, a two-layer network of steel occupying some 48 acres of the most valuable real estate in the world...Seldom does a visitor get a chance to explore the railroad yard beneath the 722-foot roof of the main station building and the cavern of rock, steel and concrete which leads the road northward underneath Park Avenue.”

Popular Mechanics, November 1944

400



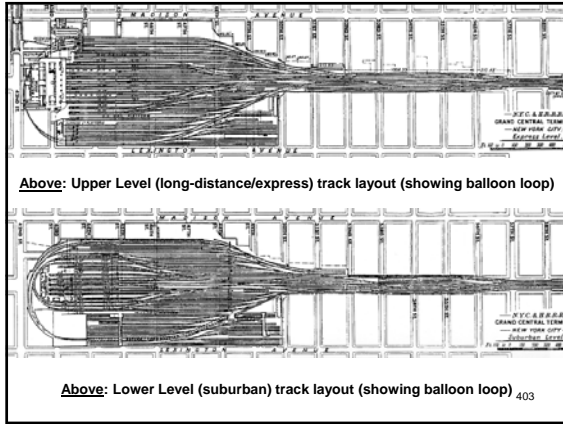
Top Left: train shed tracks
Top Right: loop tracks
Left: ladder tracks in an “Interlocking” area of the train shed. The tracks are controlled by signals, switches and control equipment housed in a signal tower which is controlled by a tower operator.

401

“The area occupied by the express level equals 46.4 acres, and the plans provide for 19.5 miles of track. There are 42 tracks on this level, of which 29 are adjacent to platforms, while the total length of these tracks along platforms on this level is 28,850 feet...Immediately east of the inbound tracks are located 22 stub and outbound tracks, while east of these there are 11 tracks for the loading of baggage, mail and express, and for storage, with three running tracks beyond connecting with the loop. Between the ladders leading to the outgoing tracks and loop tracks, there are two storage yards for equipment, while the third yard for similar purposes is located in the corner near Fiftieth street and Lexington avenue. A total storage capacity of 1,050 cars is secured on this and the lower level.”

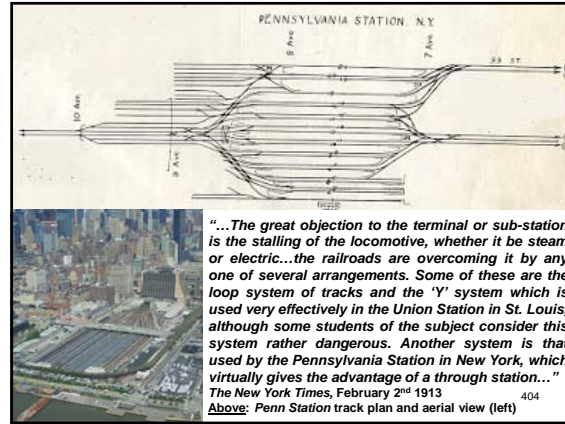
Railway Age Gazette, November 22nd 1912

402



Above: Upper Level (long-distance/express) track layout (showing balloon loop)

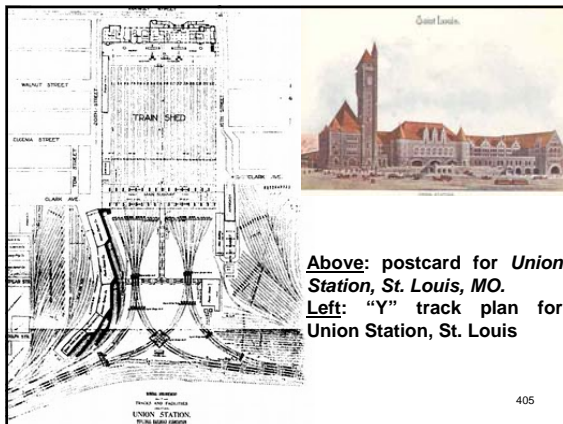
Above: Lower Level (suburban) track layout (showing balloon loop) 403



"...The great objection to the terminal or sub-station is the stalling of the locomotive, whether it be steam or electric...the railroads are overcoming it by any one of several arrangements. Some of these are the loop system of tracks and the 'Y' system which is used very effectively in the Union Station in St. Louis, although some students of the subject consider this system rather dangerous. Another system is that used by the Pennsylvania Station in New York, which virtually gives the advantage of a through station..."

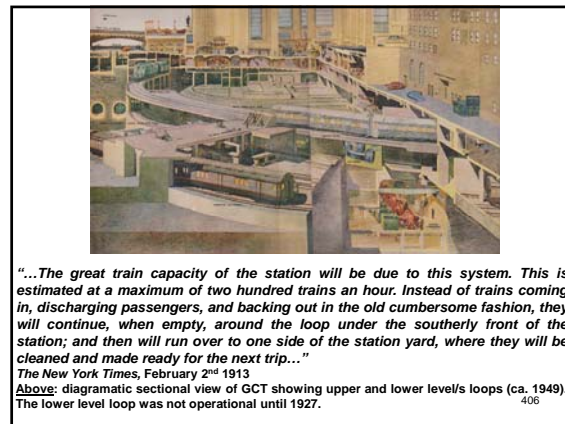
The New York Times, February 2nd 1913

Above: Penn Station track plan and aerial view (left) 404



Above: postcard for Union Station, St. Louis, MO.
 Left: "Y" track plan for Union Station, St. Louis

405



"...The great train capacity of the station will be due to this system. This is estimated at a maximum of two hundred trains an hour. Instead of trains coming in, discharging passengers, and backing out in the old cumbersome fashion, they will continue, when empty, around the loop under the southerly front of the station; and then will run over to one side of the station yard, where they will be cleaned and made ready for the next trip..."

The New York Times, February 2nd 1913

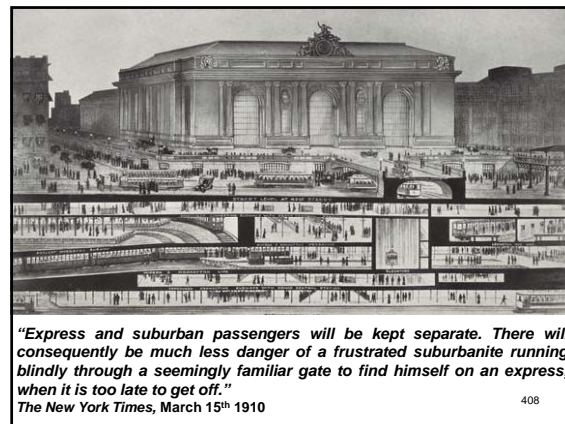
Above: diagrammatic sectional view of GCT showing upper and lower level's loops (ca. 1949). The lower level loop was not operational until 1927. 406



"...The necessity of some such system as the 'loop' is better appreciated when the magnitude of the train dispatcher's task at the new terminal is realized. It must be remembered that it has a total of sixty-eight tracks, of which forty-six have platforms, as against twenty-one tracks in the Pennsylvania Station, thirty-two in the South Station, Boston, or the St. Louis Union Station, and against eighteen in the Frankfurt-on-the Main Station, Germany..."

The New York Times, February 2nd 1913

Above: B&W (left) and color (right) rendering/s of a cross-sectional view of the many levels of the new Grand Central Terminal (ca. 1912) 407



"Express and suburban passengers will be kept separate. There will consequently be much less danger of a frustrated suburbanite running blindly through a seemingly familiar gate to find himself on an express, when it is too late to get off."

The New York Times, March 15th 1910

408

A Gigantic Rabbit Warren

409

"...the new terminal has been built to last for many years to come. How many years no one knows...No one assumes that the present terminal will serve forever, but, according to the Grand Central authorities it will be fit to permit the passing through its gateway of 100,000,000 persons every year. When the traffic exceeds that, who knows?..."

The New York Times, February 2nd 1913

RE: by 1926, 15K residents and 25K workers of the Grand Central Zone could reach their homes and/or offices via GCT without ever stepping outside. It was likened to "a gigantic rabbit warren."

410

Part 6

The Great Terminus

411

Every Nook and Corner

412

"Grand Central Terminal is the center of the most extensive combination of passenger transportation lines in the world On Forty-second street there will be the completion of the Belmont Tunnel to Long Island, the Hudson & Manhattan Tunnels to New Jersey and the Lexington Avenue Subway, four great arteries of local transit, including the present Interborough Subway, having direct sub-surface connections with both the outgoing and incoming stations of Grand Central Terminal. In addition, electric surface lines, radiating in all directions, pass the door...There is thus established and intercommunication of travel between the New York Central Lines and the lines of local transit that places every nook and corner of Greater New York, Long Island and Jersey City in direct touch with this great railway terminal."

Bankers' Magazine, January 1913

413



Most Active Spot the World Has Ever Known

415

“...Grand Central Station as the main entrance to New York City is naturally a most important point in the local rapid transit system. The present Interborough Subway was laid out to pass its doors, the new Lexington Avenue Subway will come down its eastern side, and the McAdoo Tubes are to be carried up Sixth Avenue and under Forty-second Street to bring passengers from New Jersey to the great terminus. Three lines were designed to reach the Grand Central Station because of its existence, but to them must be added the very important Steinway Tunnel line, which will run across town to Times Square and was built from the end of Forty-second Street more fortuitously...”

The New York Times, February 2nd 1913

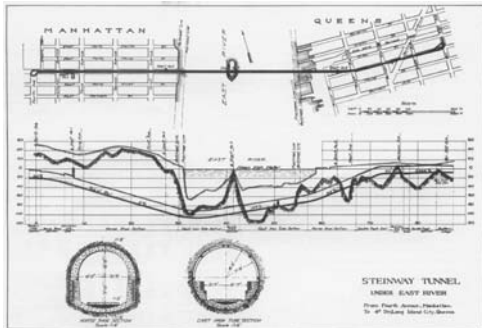
416

The Steinway Tunnel

417

On February 25th 1885, a group of prominent Long Island businessmen incorporated the East River Tunnel Railroad Company, under the General Railroad Act of 1850. The purpose of their plans was to construct a tunnel railroad from Ravenswood, north of Long Island City, to a convenient point in Manhattan that would serve as a direct connection between the Long Island Rail Road and the New York Central & Hudson River Railroad. An engineering firm was hired to survey the river bottom for appropriate tunnel sites, but after this work was accomplished nothing more was done. In 1887, the company was reorganized as the New York & Long Island Railroad Company. On January 13th 1890, the route was finalized in a map filed in the register's office that placed the tunnels under 42nd Street. This map was also the first to show the Long Island City route. The Manhattan route was as follows: begin under the corner of W. 42nd Street and 10th Avenue, then easterly under 42nd Street to the East River. At W. 42nd Street and 10th Avenue, the line was to surface and split into two spurs. One spur was via open cut and private right-of-way to W. 43rd Street and 11th Avenue, with track connections to the NYC&HRRR while the other spur was to terminate at a Hudson River pier (via private right-of-way) at W. 41st Street and 11th Avenue. William Steinway, founder of the Steinway & Sons Piano Company, owned a sizable part of Long Island City real estate and owned the Steinway and Hunter's Point Railroad which was a local horse car line. By obtaining control of the tunnel company, it would increase the value of his properties. It was his plan to operate the tunnels by electricity which had recently been harnessed for electric traction motors. Stations were to be scattered along the route for both passenger and freight service.

418



419

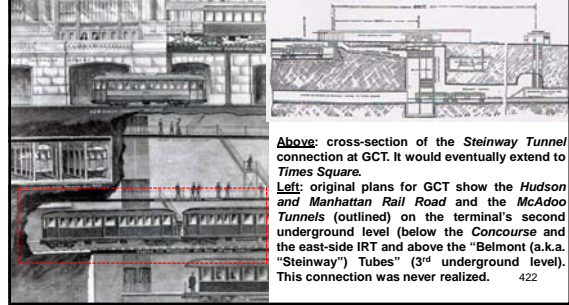
The financial Panic of 1893 and continual flooding caused the tunnel to be abandoned on February 2nd 1893. From that time until Steinway's death in 1896, periodic attempts were made to revive the project. In February 1902, August Belmont, Jr. took an interest in the project. Belmont had inherited his fathers vast fortune in 1890 and was an astute financier in his own right. He was also a friend of Steinway and watched with interest the progress and subsequent failure of the tunnel project. He entered the tunnel construction field in New York in 1900 by assuming the cost of building the Interborough Rapid Transit Company (IRT) and its plan of equipping and operating the first subway. The revived tunnel program became known as the "Belmont Tunnels" (although Belmont preferred to have them known as the "Steinway Tunnels"). New Preliminary surveys and tunnel plans were prepared between 1902 and 1905, when construction was resumed. About the time this was all taking place, the Pennsylvania Railroad acquired control of the Long Island Railroad (LIRR) and announced plans for the tunneling of both the Hudson and East River/s as well as the construction of a huge station between 32nd and 33rd Street/s in Manhattan. Plans were also being pushed by the New York Connecting Railroad to tie in the LIRR, the New York, New Haven & Hartford Railroad, and the Pennsylvania Railroad via a huge bridge over the Hell Gate section of the East River which would nullify the earlier plans of the Steinway Tunnel backers. With the tunnels being planned for a lighter form of traction, costs could be lowered somewhat. With the changing of the plans, the connections originally proposed to the NY&HRRR were dropped and the tunnel terminal in Manhattan was to be a two track pocket under Park Avenue and E. 42nd Street. However, this was changed to a loop plan in 1904.

420



Above: view looking south at Hell Gate Arch (left) and portion of the RR viaduct (over Ward and Randall Island/s, ca. 1927). The Bronx is in the foreground, Manhattan at right, Queens at left and Roosevelt Island and the Queensboro (a.k.a. 59th Street) Bridge at top left-center. Trains crossing the Hell Gate Arch could continue through the East River Tunnel/s to Penn Station and/or enter the Sunnyside Yard. Another integral leg of the New York Connecting Railroad (NYCRR) brought freight trains to terminals on the Brooklyn waterfront, but no further. The intended cross-bay tunnel at the Narrows was never realized. 421

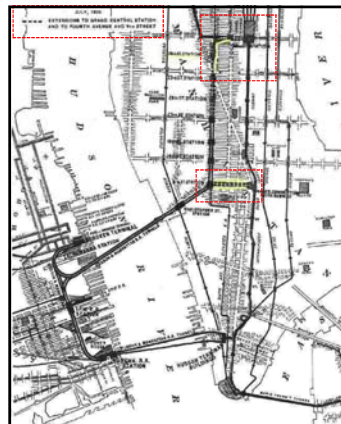
“...the Interborough Subway has been built on the first level just below the surface of the street...the Lexington Avenue Subway will occupy the first level along that thoroughfare. Then the Steinway Tunnel...by reason of the necessity of getting beneath the bed of the East River, is on the third level...This leaves the second level to the McAdoo tubes...”
 The New York Times, February 2nd 1913



Above: cross-section of the Steinway Tunnel connection at GCT. It would eventually extend to Times Square.
Left: original plans for GCT show the Hudson and Manhattan Rail Road and the McAdoo Tunnels (outlined) on the terminal's second underground level (below the Concourse and the east-side IRT and above the "Belmont (a.k.a. "Steinway") Tubes" (3rd underground level). This connection was never realized. 422

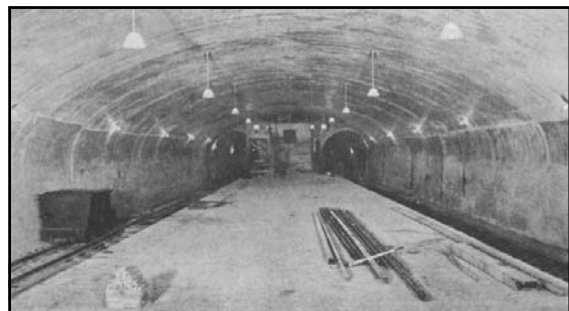
“...The lowest of all will be the Steinway Tunnel, which will have immediately above it a mezzanine floor. Access to this will be obtained either by a stairway or by an elevator, which will run straight down from the great concourse of the subway system, which will be to all intents and purposes merely an extension of the concourse of the Grand Central Station itself. Then, above the Steinway Tunnel's mezzanine, will come the level consecrated to the McAdoo tubes...The trains from New Jersey, according to the rough idea at present entertained, will run in on two tracks, each of which will come to a dead end. A cross-over just outside the station will allow the trains to reach any track...”
 The New York Times, February 2nd 1913

423

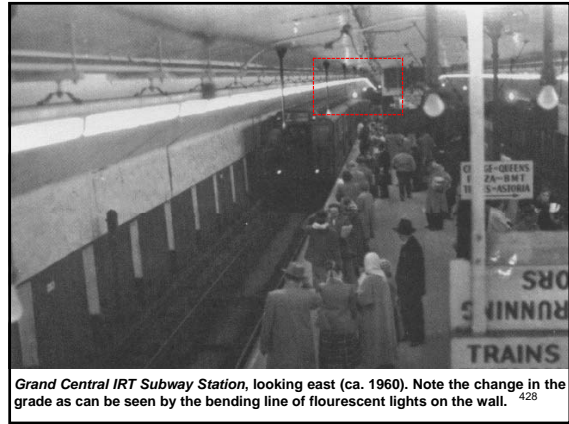
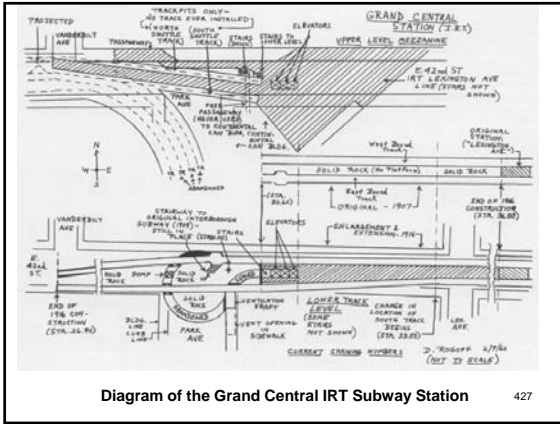


Left: map of the Hudson & Manhattan RR's planned Manhattan extensions, July 1909 (highlighted in yellow and outlined). Eastwards from 9th Street to the east side IRT (bottom) and northwards from 33rd Street to GCT (top) were never completed, although the long and extremely wide IND pedestrian tunnel under Sixth Avenue from 34th to 36th Street/s is a vestigial remainder of the planned but never realized northwards extension of the New Jersey commuter line. 424

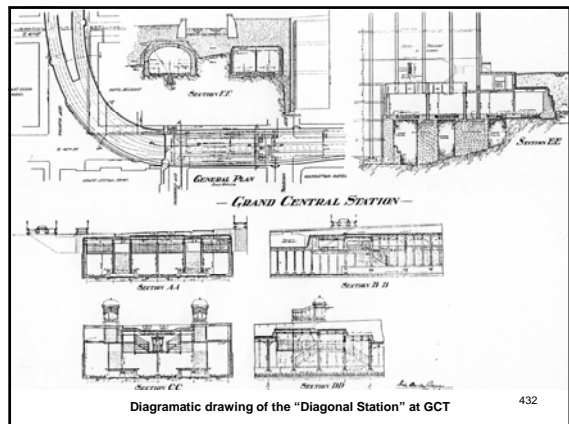
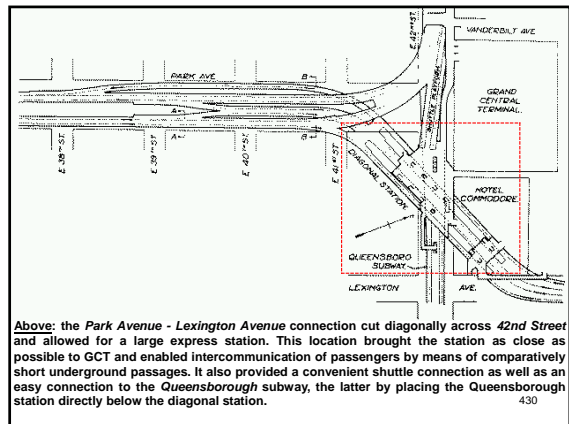
Belmont offered to sell the completed tunnels to New York City in 1907 over the objections of the Public Service Commission. Between the years of 1907 and 1915, the tunnels lay idle. On April 3rd 1913, the City of New York purchased the tunnels from Belmont for the construction of new subways and the extensions to existing lines. The original IRT plan was to resume trolley car operation through the tunnels, but this was discarded in favor of regular rapid transit train service. The tunnels were measured and only slight modifications were needed to allow for third rails and shoe clearance. The tunnel grades on the Queens side were as high as 4%, which were higher than elsewhere on the IRT. It was questionable whether the standard IRT car would operate efficiently on such grades so a revised type of subway car was designed and called the "Steinway." The Steinway was a motor car identical in appearance to the standard type of car but was lighter and had different motor gearing. It would only couple electrically to other similar cars or the later "World's Fair" cars. On June 22nd 1915 the official opening ceremonies were held at the Jackson Avenue (Queens) station with a speech given by August Belmont, Jr. A week after the opening, the official name of the line was changed to the "Queensboro Subway" (at the behest of the Queensboro Chamber of Commerce). 425

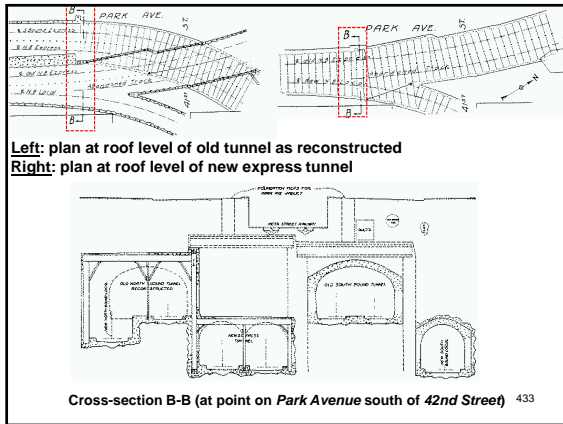


Above: GCT's IRT Subway Station prior to commencing operations (June 1915). The station runs in a northeasterly direction and does not follow any street lines. Rather, it cuts diagonally under private property and two separate streets. Grand Central Station was later lengthened by 535-feet (to the west) making it the longest station on the IRT. 426



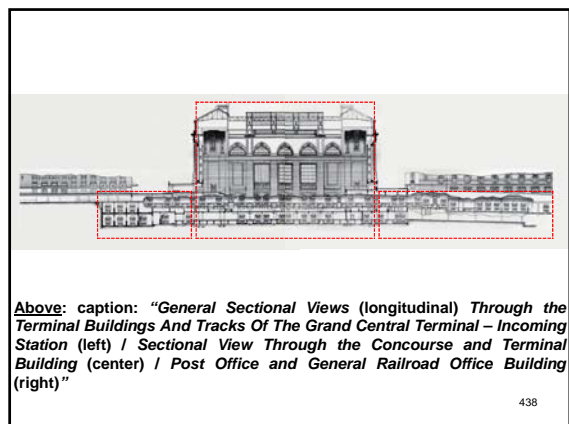
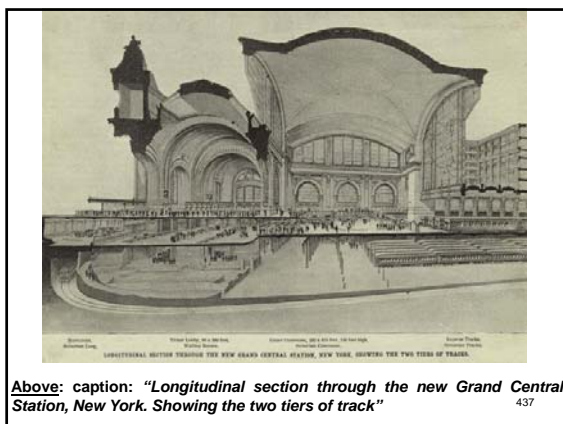
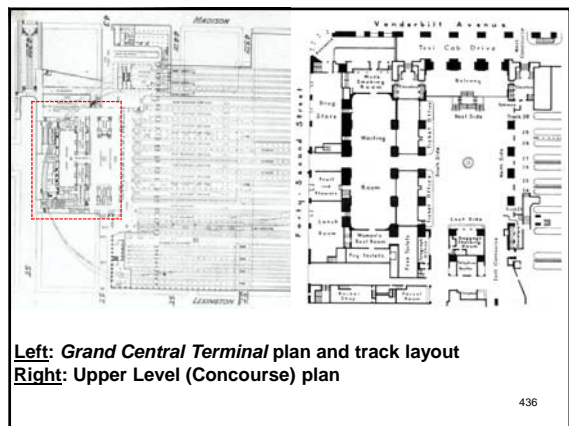
“...Above the McAdoo level will be the stratum on which both the present subway and the new Lexington Avenue trains will run. It is proposed to bring the Lexington Avenue line into Park Avenue by a curve under the site of the old hospital and the Grand Union Hotel, with the station stretching from Forty-third to Forty-first Street. Thus the two subways will meet at an angle a block or so south of Forty-second Street, and there will be plenty of space between them as they approach, to construct a large exchange station for passengers who wish to transfer from the Lexington Avenue across town by the shuttle service to the west side line at Times Square. They will only have to cross the platform without ascending or descending any steps. From this the ascent to the street will of course be easy, and it is the street which forms the sixth level from the bottom of the series...”
 The New York Times, February 2nd 1913 429






"...The grand concourse floor of the terminal is on a level with the mezzanine or ticket-window floor of the subway. This distinction was accorded the concourse because it was found, by counting, that about eighty percent of the passengers coming to and leaving the terminal did so by way of the Interborough. Part of the complete terminal will be a great joint subterranean station for the converging lines of the city's underground transit. It will be shared by the present subway, the extended McAdoo tubes, the Steinway tunnel and the Lexington Avenue subway. All these and the surface and elevated lines will pour an unending stream of traffic into the waiting terminal, making it, perhaps, the most active spot the world has ever known..."
 The New York Times, February 2nd 1913

435



"...the improvements will be possessed of an immense earning power that will go far toward making an adequate return on the entire investment. One of the most important and most interesting chapters in the world's history of railroading will be written when practice shows to just what extent the development of the air rights will serve to meet the overhead charges of the terminal and when it can be definitely stated to just what extent a big terminal in a big city can of itself be made a source of revenue instead of a tax upon the traffic..."
The New York Times, February 2nd 1913

439



Wilgus faced two problems now that the electrification and new terminal were given the blessings of the NYCRR's upper management;

- How to raze the old *Grand Central* while building the new terminal without disturbing train traffic flow;
- How to electrify the line and for what distance

For the latter, rather than electrifying the line just to the *Harlem River* (to satisfy the law), he determined it best to electrify the entire *Harlem Line* (extending twenty-three miles to *White Plains*) as well as the *Hudson Line* (extending thirty-three miles to *Croton*). Wilgus recognized the growing trade in commuters and doubted they would want to waste time transferring to steam locomotives once across the *Harlem River*. As well, the superior accelerating characteristics of electric trains made them ideal for a commuter railroad. However, electric motive power for trains was still in its infancy and had never been attempted on the scale Wilgus was proposing. There were many unknowns.


440

Electric Train Service Now

Mount Vernon—Bronxville—Tuckahoe
Crestwood—Scarsdale—Hartsdale
White Plains—North White Plains

THIS solves the problem of living both in the City and out of it. It is only a matter of a few more minutes in the cars to secure lower rents—or your own home or farm—with sure and easy access to the life of the great city when desired. You keep the city income and make only the country expenditures.

SEND FOR BOOKLET
 "Suburban Homes on the New York Central Lines"
 which sets all about available homes, gives complete list of real estate dealers in this territory, as well as the territory served by the Hudson River and Putnam Division, and the West Shore Railroad. Address: Advertising Dept., Room 709, Grand Central Station, New York




New York Central Electric Suburban Train—Steel Car—Seating 2000. Round and Oblong.

Above: newspaper advertisement for suburban electric train service on the New York Central Railroad (April 1910)

441

The Rock-Bottom Fact

442

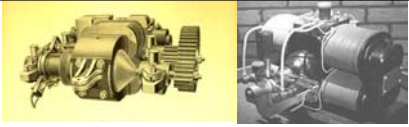


"...All this terminal city, this assemblage of buildings of such varied purposes, was made possible by the installation of the electric motor. The scheme could not have been carried out – it could not even have been conceived – in the day of the dirt and smoke and noise of the old steam locomotive. The rock-bottom fact of the entire enterprise is the electric motor, powerful, swift, silent, and clean..."
The New York Times, February 2nd 1913

443


The Father of Electric Traction

444




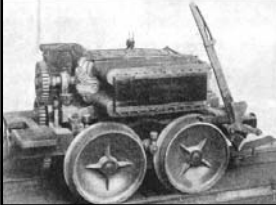
"No existing railroad electrification anywhere in the world approached the scale of the Central's project or provided a model to duplicate"
 Kurt C. Schlichting, Author

RE: in 1885, an electric traction engine made an experimental debut on the *Ninth Avenue Elevated* line in NYC. Its slow speed and hazard from sparks proved unsatisfactory, and that was for a short-distance line - not long-distance as was being proposed. In 1897, *Frank Julian Sprague* - an associate of *Thomas Edison*, adapted a device he had invented for elevators to a tandem railroad car, each with its own electric motor capable of regenerating (returning) power to the main supply of electric motor driven equipment (for economy and braking). Additionally, Sprague developed a distorted system of compound field magnet winding that maintained a fixed, non-sparking position of commutator brushes and a three-point, wheelbarrow suspension of axle-mounted geared motors for electric railways, which was soon used universally for trolley-car equipment (1884 Sprague electric motor above). Unfortunately, the imperative for electric powered locomotives was still a few years away. ⁴⁴⁵




"A practical motor has been a want seriously felt in our system. The Sprague motor is believed to meet all the exigencies of the case, and the Edison Electric Light Company feels it can safely recommend it to all its licensees as the only practical and economic motor existing today."
 Thomas Alva Edison

RE: in 1883 (after resigning from the U.S. Navy) Sprague (left) became a technical assistant to Edison. In 1884, he resigned his position and started the *Sprague Electric Railway & Motor Company*. During the next two years, Sprague produced a number of inventions of major significance. The first was a constant-speed, non-sparking motor with fixed brushes. It was the first motor to maintain constant revolutions per minute (rpm) under differing loads. Sprague's invention caused such a stir at its first showing at the *Franklin Institute's Electrical Exhibition* in *Philadelphia* that the company sold 250 motors in just two years. ⁴⁴⁶

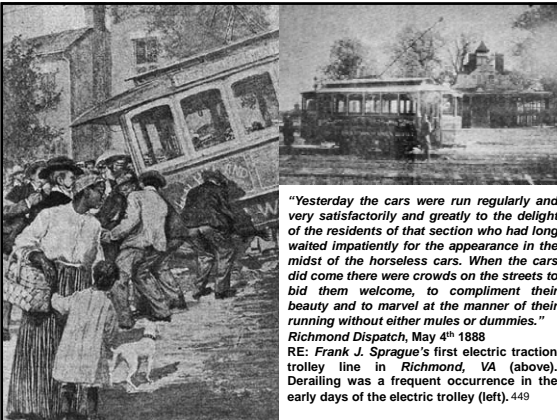



Above: the *Siemens Electric Railway*, laid down at the *Berlin Exhibition of 1879*. The short line was about six-hundred yards long and current was drawn from a third-rail between the track which acted as the return to the dynamo. The locomotive hauled a maximum of thirty passengers at a speed of about four mph. This photograph shows one of the earliest trainloads of passengers, seated upon three carriages.

Left: the three-HP electric locomotive built by *Werner von Siemens* for the Berlin Exhibition. The engine, which created a great sensation in its day, was mounted on a truck with the drive to the axle through spur gearing. ⁴⁴⁷

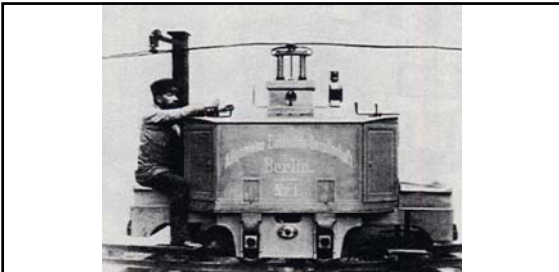


Sprague incorporated many of his inventions in the equipment his company installed for the *Richmond, Virginia Union Passenger Railway* (above) in 1887-1888; the first large-scale electric trolley line in the world. Within two years of its opening, 110 electric railroads using Sprague's equipment were built or under contract, including systems in *Italy* and *Germany*. ⁴⁴⁸

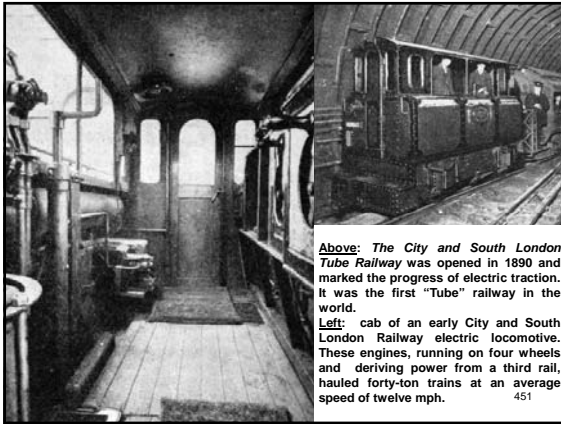


"Yesterday the cars were run regularly and very satisfactorily and greatly to the delight of the residents of that section who had long waited impatiently for the appearance in the midst of the horseless cars. When the cars did come there were crowds on the streets to bid them welcome, to compliment their beauty and to marvel at the manner of their running without either mules or dummies."
 Richmond Dispatch, May 4th 1888

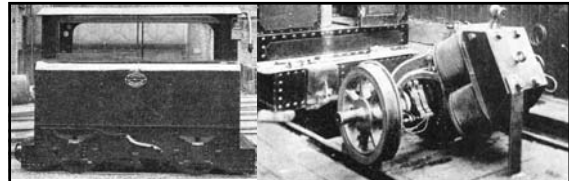
RE: *Frank J. Sprague's* first electric traction trolley line in *Richmond, VA* (above). Derailing was a frequent occurrence in the early days of the electric trolley. ⁴⁴⁹



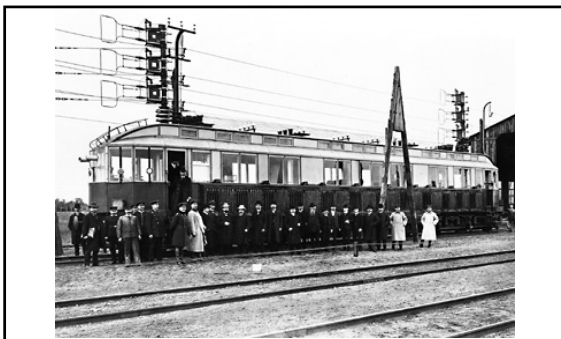
Above: in 1883, the "*Geleghenheits-Gesellschaft*" was founded by *Emil Rathenau* in *Berlin*. During the first years the company concentrated on the construction of illumination equipment. However, in 1888/89 its portfolio was quickly expanded to the construction of electrical railways based on the patents of the American inventor *Frank J. Sprague*. In 1889, a separate *AEG Railway Division* was founded which was responsible for the construction of the first electrical tram line in *Halle* in 1891. ⁴⁵⁰



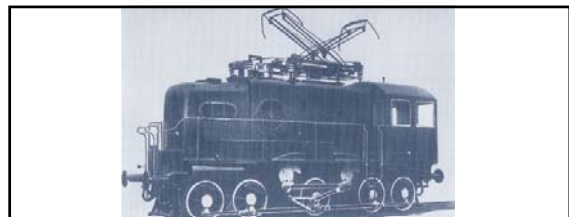
Above: The City and South London Tube Railway was opened in 1890 and marked the progress of electric traction. It was the first "Tube" railway in the world.
 Left: cab of an early City and South London Railway electric locomotive. These engines, running on four wheels and deriving power from a third rail, hauled forty-ton trains at an average speed of twelve mph. 451



Left: Electric Locomotive No. 1 on the City and South London Railway. The engine had four wheels and weighed about twelve-tons. It was fourteen-feet long, 6-feet, 8-1/2 inches wide, and 8-feet, 6-inches high. Each axle was driven by an independent motor. These motors each developed 50-HP, giving a tractive effort of 3K-pounds.
Right: undercarriage of Electric Locomotive No. 1. The armature (seen in the photograph) were built directly on the axles. The field magnets surrounding the armatures, were supported by brackets bearing on the axles and by links connecting the yokes to a cross beam of the locomotive frame. 452



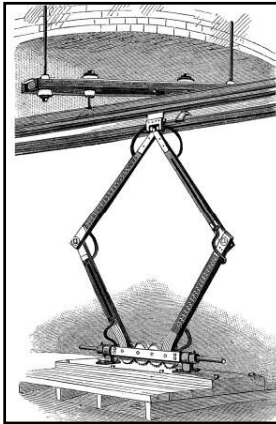
Above: in October 1903, the Siemens three-phase express electric railcar reached a speed of 210 km/h between Marienfelde and Zossen (near Berlin) 453



Managed by Kalman Kando (1869–1931), the Ganz Factory (Hungary) played a role in manufacturing railway engines for electric traction in the late 19th Century. Ganz produced the first three-phase engine commissioned to operate along the banks of Lake Geneva in 1898 (above). Engines of the same make were used along the Valtellina railway in Italy at the beginning of the 20th Century (1902). This was the world's first railway section operated with high voltage Alternating Current (note the Pantograph atop engine to supply the electric motor with power from overhead Catenary power lines), with every essential component developed under the direction of Kalman Kando at Ganz. 454

A debate ensued as to which type of current; AC or DC, should be applied to electric railways. George Westinghouse advocated the former while Thomas Edison and Frank Sprague lobbied for the latter. The NYCRR followed the lead of the Baltimore & Ohio Railroad selecting Direct Current (DC) energizing a third-rail delivering power to the each electric car via a "shoe" (extending from the motor). The Central began operating electric trains from Grand Central in 1906 – two years ahead of the mandate. The New Haven line followed suit in 1907 using DC on the Central's line but switching to an Alternating Current (AC) via an overhead pantograph on their own lines in Connecticut. Because of the New Haven & Hartford Railroad's decision to use 11K-Volt AC overhead motive power on its own tracks from New Haven, CT to the junction with the New York Central system at Woodlawn, NY, from that point on entry to GCT required third-rail, 660-Volt DC. For through trains, the New Haven switched to Pennsylvania Station in 1917, but trains terminating in New York used GCT. This required the New Haven trains to lower their overhead pantograph collectors and unfold shoes to connect to the New York Central's third rail. 455

"...The direct-current system, it is said, has the advantage that the third rail affords a more compact and ship-shape system of construction; that the pressure is lower; and that the risks of accident are reduced practically to the vanishing point..."
 The New York Times, February 2nd 1913 456



There were serious operational deficiencies still to be resolved. Single-phase AC technology was still being developed at the time and the installed system had little in the way of power factor compensation and regulation was limited. Also, overhead catenary wire suspension and the Pantograph power collectors both suffered from a variety of mechanical problems. As a result, the New Haven line had major start-up problems and, initially, New York Central locomotives had to be used to pull the New Haven trains between Grand Central and Woodlawn, with steam power retained on the New Haven property. In the first months, the situation appeared so bleak that New Haven management threatened Westinghouse with litigation if the problems weren't resolved. In time, the difficulties were overcome but the initial problems underscored the wisdom of Frank Sprague's insistence on the superiority of DC traction for GCT.

Left: Early (1895) flat Pantograph on a Baltimore & Ohio Railroad electric locomotive. 457



"The electrical engineers and management of the New Haven Railway were bold indeed to venture into a new and relatively untried system of electrification...now this system is almost universally preferred for long distance, heavy traction, railway electrification"
 C.E. Smith, Vice President - New Haven & Hartford Railroad 458



Above: early Sprague MU cars on the South Side Elevated Railroad in Chicago, Illinois (April 1898). A new fleet of 180 MU Sprague-GE cars (the "GE" was added to the name of the cars after General Electric bought the Sprague Electric Company) were introduced for suburban travel, and testing of the electric locomotives started in 1904. The locomotives included many innovations, one of which was a gearless "bipolar" motor, based on earlier Sprague concepts. As late as 1981, some of these locomotives were still in use in the GCT yards. Power was supplied by two railroad generating stations (one at Glenwood, in Yonkers and the other at Port Morris, in the Bronx) to conversion substations that supplied 660-V DC traction power. Substations were a standard technology for street railway and utility companies (a technique that Frank Sprague had first proposed in 1886 in a report to the Edison Electric Illuminating Company of New York). Limited electric train service from Grand Central began in September 1906, but GCT and electrification of the tracks all the way to Croton-on-Hudson were not completed until 1913. The GCT installation operated with minimal problems. MU cars quickly assumed the commuter runs, while the electric locomotives took over long-distance trains in the electrified zone. Top speed for electric locomotives was 40 mph while the multi-unit suburban trains reached 52 mph. 459



"With the exception of the jolting up of the passengers in the run from Fifty-sixth to Fifty-second Street over a 'dead' track and the old style interlocking switches, the trip was made with the usual speed and a great deal more comfort than the ordinary method of railroad traffic affords. The party, made up of electrical engineers from all over the country and many railroad men gathered at Highbridge to enter the train, which was made up of two private cars and two Pullman coaches."
 The New York Times, October 6th 1906 460
 Above: electric test train/party assembled under Highbridge in the Bronx

Nosing

461



CENTRAL WRECK--19 DEAD.
 Crowded Electric Train on Harlem Division Jumps Track Near 205th Street--100 Injured.
FOUR CARS LEAVE ROAD AT CURVE.
 Division Superintendent Says Broken Rail Caused Accident--One Old Passenger Coach Caught Fire--Cars Swung to Kindling Wood.

"Dashing northward through the Bronx at a speed, some say of sixty miles, others a hundred, but officials claim only of thirty-five or forty miles an hour, the White Plains and Brewster Express, one of the first new electric trains over the New York and Harlem Division of the New York Central Railroad, was wrecked in fearful fashion near 205th Street at 6:40 o'clock last night. It was in many respects the worst wreck the Central has had in years. At midnight it was estimated that eighteen persons were dead, including many women, and more than 70 injured, many of them seriously. The train consisted of five passenger cars with two of the new electric motor cars ahead of them. Near 205th Street four of the five passenger cars, beginning with the last, toppled over on their sides, left the tracks, and with the shrieking passengers in them, were dragged over the ties for a distance of nearly 200 yards before the train was brought to a standstill."
 The New York Times, February 17th 1907 462

In the early evening of February 17th 1907, the 6:15 express to *White Plains* flew off the tracks as it rounded a curve in the *Woodlawn* section of the Bronx (at 205th Street). It was a serious accident. Twenty commuters died at the scene and another one-hundred and fifty were critically injured. Memories of the January 1902 *Park Avenue Tunnel* crash, little over five years earlier, were still in the public consciousness. If not, the local press was sure to remind them. The NYCRR officially blamed a faulty rail, but they knew better and so did Chief Engineer Wilgus. "Nosing" was a problem whereby the disproportionate weight of the electric engine towards the front tended to spread apart the rails. The NYCRR and *General Electric* as well as Wilgus were aware of the problem and were making efforts to correct it. In a report after the accident, the Chief Engineer meticulously documented his findings outlining nosing as the cause of the crash. If this report became public, it would be devastating to the NYCRR and Wilgus was advised to destroy it by the RR's chief counsel and complied. When in the summer of 1907 Wilgus learned that the Central was redesigning the electric engines without consulting him, he resigned from his very respectable \$40K per year position as Chief Engineer of the *New York Central Railroad*. To prevent the Central from making him a scape-goat for the accident, Wilgus carefully re-created his findings and sent the papers to the *New York Public Library* for safe-keeping. He let it be known to the senior management at the NYCRR that the papers existed and if they had any ideas of trying to blame him for the February 1907 accident, the papers would "go public." The papers remained unopened in the NYPL until after Wilgus' death in 1949 and remain archived there.

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Left: prototype ALCO/GE *New York Central & Hudson River Railroad* electric locomotive (as depicted on a 1907 postcard)

Right: S-motor 109 was part of the initial order of electric locomotives built for GCT service by *Alco* in 1906. While replaced by larger locomotives, many served into the 1960s as switchers, the last being retired by the MTA in 1981. In the spring of 1946, the country found itself gripped by a nationwide strike staged by coal miners and railroad workers. President Truman seized control of the railroads and demanded both sides work out their differences. They eventually did (at the threat of being drafted) and, no doubt, these *New York Central* employees were glad to be going back to work.

464



Clockwise from top left: R-S-T electric engines/ of the NYCRR

465

20th Century Limited

A Night of Rest
Between New York or Boston and Chicago

That is what you can count upon when you take the famous *Twentieth Century Limited* over the graceful "Water Level Route" of the *New York Central Lines*. All the conveniences of your home—the luxuries of the finest hotel or club—add to your comfort and enjoyment.

Lv. New York 4.00 p.m.	Lv. Chicago 2.30 p.m.
Lv. Boston 1.30 p.m.	Ar. Boston 11.50 a.m.
Ar. Chicago 8.55 a.m.	Ar. New York 9.25 a.m.

"The Train that Saves a Business Day"

NEW YORK CENTRAL LINES

Above: the NYCRR exploited the concept of "air rights" to build over their property, which would eventually completely cover over the tracks. But when GCT first opened, not everything was covered. In this scene from June 1914, the platforms are exposed and a T-1 electric engine is leading the Central's flagship *Twentieth Century Limited* (period ad at left) from GCT.

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Top Left: an engineer waves as his diesel-electric locomotive arrives at GCT (1934)

Top Right & Left: a NYCRR streamlined locomotive races towards *Chicago* pulling the *20th Century Limited* behind at up to 123 mph. It could make the 961 mile trip between GCT and *Chicago's LaSalle Station* in 960 minutes.

467

"To demonstrate that steam remains supreme in railway transport, the *New York Central Railroad* operated from *Albany* to *New York* yesterday a streamlined edition of its *Twentieth Century Limited* behind a locomotive which, in trial runs, had attained a speed of 123 miles an hour. Described as a 'luxury liner,' the train consisted of light-weight steel cars. Built at a cost of \$6,162,000, the train was an expression of the best engineering talent of the railroad and of the *Pullman Company*. When it goes into regular service on June 15 it will cut the present minimum running time between *New York* and *Chicago* by a half hour, making the run in sixteen hours....*New York Central* engineers aboard the train asserted that neither electric nor Diesel-electric locomotives could surpass the rating of the new *Twentieth Century* engine. Although the new locomotive has a power rating 15 per cent ahead of its predecessor types, it weights two and one-half tons less."

The New York Times, June 10th 1938

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Above: eighty-thousand people turned out to see the engine and tender of a new streamlined train: *The Burlington Zephyr* (New York to Boston run), on view in GCT (December 1934). The NYCRR planned to gradually convert all of their locomotives to this newer, more aerodynamically efficient type. ⁴⁶⁹

"It had the self-assurance of a Wall Street Banker's business suit, with blue chalk stripes and an Art Moderne drumhead glowing red and blue as it raced along the right-of-way"
Al Gengler, Railroad Enthusiast
 RE: the streamlined locomotives of the *20th Century Limited*. At night, the engine's wheels were lit for maximum speed effect. The only competition for the Limited was Pennsy's *Broadway Limited* which had begun competition with the Limited for the *New York to Chicago* run in 1912. By the mid-1930s, it too was featuring streamlined locomotives. ⁴⁷⁰

Streamlined to the Last Rivet

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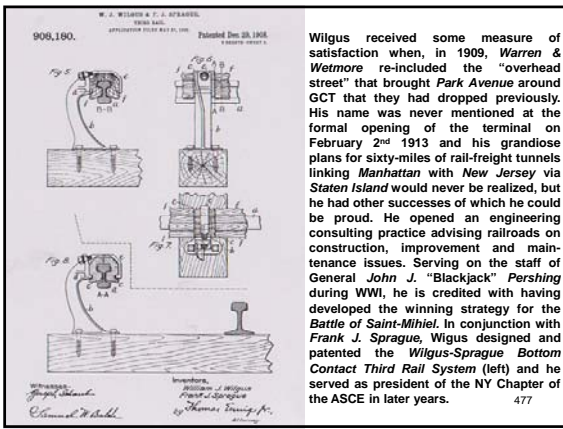
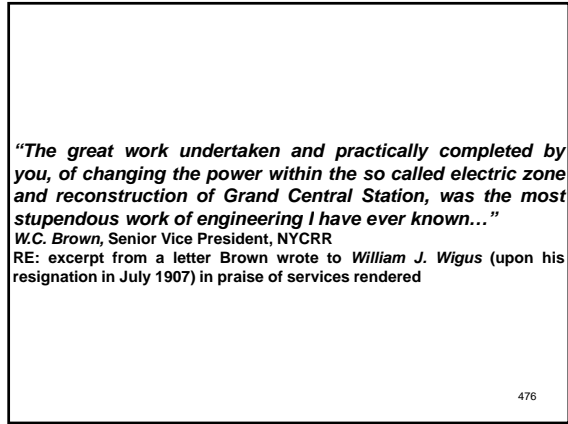
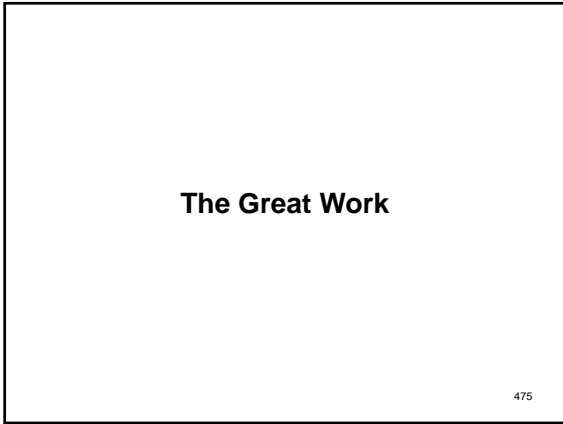
"The Flash Gordon zip and gleam of modern, streamlined, air-conditioned railway travel have been taken for granted for years by cinemaddicts, toy makers, and U. S. travelers in the West. Last week Eastern railway passenger travel suddenly got Flashed up when two of the nation's most famous trains, New York Central's Twentieth Century Limited and Pennsylvania's Broadway Limited, were streamlined to the last rivet and brake beam and made into the first all-room Pullman trains in the U. S. Tie-for-tie competitors for 36 years, the Century and Broadway, now alike in contour as a brace of eels, glided off this week on the Manhattan-Chicago run in what looked like another dead heat. Each was scheduled to make the run in 16 hours, a half-hour faster than before. This meant that Central's blue-streaked, silver Century must cover its 960 miles in 960 minutes, the gold-banded, Tuscan-red Broadway its 908 miles in the same time...The new Century and Broadway are composed of company-owned baggage and public cars coupled with matching all-room sleepers built by Pullman Co. Each has eight all-room Pullmans, accommodations including snug roomettes, single and double bedrooms, compartments, drawing rooms. Each has two diners. The Century's, informal but sober, stick to rust tones and grey. The Broadway's, more splendiferous, have a speak-easy style midsection with side-seat nooks. Each has a bar-lounge, the Century's, mannish, leathery, the Broadway's, like an intimate cocktail room."
Time magazine, June 20th 1938 ⁴⁷²



With hundreds of commuter and long-distance passenger trains using *Grand Central Terminal* daily, the car inspectors were kept busy. Trains would arrive, be pulled into the yards, turned around, and be made ready for departure as quickly as possible. Car inspectors were responsible for checking and certifying that everything was roadworthy. It was dirty, grimy work climbing under and around the trains as they sat at the platforms. ⁴⁷³



Above: at the foot of Tracks 20 and 21, the newest in locomotive technology (*New Haven Railroad's EMD FL9* on the left, built 1956-1960) and some of the oldest (*New York Central's T-3* class of electric on the right, built 1929-1930). The New Haven Railroad served GCT as well as the *Pennsylvania Station*. Both required the use of a third rail to enter the tunnels which led to EMD developing a "dual-mode" locomotive that could run off electric or diesel. A total of 60 FL9's were built for the New Haven, with more than half surviving to the *Metro-North* era. The last FL9 was retired in 2009, with many surviving at museums and tourist railroads throughout the eastern U.S. ⁴⁷⁴



Wigus received some measure of satisfaction when, in 1909, *Warren & Wetmore* re-included the "overhead street" that brought *Park Avenue* around GCT that they had dropped previously. His name was never mentioned at the formal opening of the terminal on February 2nd 1913 and his grandiose plans for sixty-miles of rail-freight tunnels linking *Manhattan* with *New Jersey* via *Staten Island* would never be realized, but he had other successes of which he could be proud. He opened an engineering consulting practice advising railroads on construction, improvement and maintenance issues. Serving on the staff of General *John J. "Blackjack" Pershing* during WWI, he is credited with having developed the winning strategy for the *Battle of Saint-Mihiel*. In conjunction with *Frank J. Sprague*, Wigus designed and patented the *Wigus-Sprague Bottom Contact Third Rail System* (left) and he served as president of the NY Chapter of the ASCE in later years.